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A
TREATISE
ON
Cheltenham Waters
AND
Biliary Diseases.

THIRD EDITION,
WITH NUMEROUS ADDITIONS, AND TWO PLATES.

BY
THOMAS JAMESON, M. D.

OF THE
COLLEGES OF PHYSICIANS OF LONDON AND EDINBURGH,
And Resident Physician at Cheltenham.

PRINTED BY J. K. AND S. GRIFFITH, CHELTENHAM;
AND SOLD BY LONGMAN AND CO. PATER-NOSTER-ROW, LONDON;
AND AT THE LIBRARIES IN CHELTENHAM.

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MEDICINE

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TO

MATTHEW BAILLIE,

M. D. F. R. S.

FELLOW OF THE ROYAL SOCIETIES OF LONDON AND EDIN-
BURGH, AND FELLOW OF THE ROYAL COLLEGE
OF PHYSICIANS IN LONDON.

SIR,

*The Knowledge of your Private Vir-
tues, Public Character, and Medical Writings,
induces the Author to stamp a Value upon these
Sheets, by inscribing them to so distinguished a
Physician.*

I am, Sir,

With great Esteem,

Your faithful Friend,

THOMAS JAMESON.

Cheltenham.

WILLIAM WHITTAM

1847-1914

He was a member of the first class of the
University of California at Berkeley

and a member of the

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P R E F A C E.

CHELTENHAM has arrived at that degree of pre-eminence among towns, that its name has become as familiar in the British East and West Indies, as in London. This has arisen in part from the mildness and salubrity of its climate, in consequence of the shelter it receives from neighbouring hills ; but its chief reputation has been derived from the celebrity of its springs, in curing biliary diseases, which the author's experience in tropical climates, has enabled him to explain. He has, therefore, undertaken to discuss the subjects of the climate

and mineral waters of Cheltenham, together with the means of rendering them most efficient in the cure of all kinds of diseases.

A treatise, intended for the public at large, necessarily requires simple language, which should be of an explanatory nature; the *introductory chapter*, has, therefore, been appropriated to the interpretation of technical terms, and to the elucidation of the subject matter of the subsequent pages.

Although Cheltenham has always been considered as an uncommon healthy place, yet the subject of the *second chapter*, on climate, had never been explored, until the author kept a regular météorological journal for two years, from which he has inserted two tables, with observations upon them; and his deductions may lead to further investigation of the subject. For ana-

logical illustration he endeavoured, although unsuccessfully, to obtain registers of the weather for the city of Bath, but he has received a meteorological journal for the city of Bristol, kept by Dr. Pole for eight successive years. These, compared with the tables in this treatise, make it appear, that Bristol is rather colder than Cheltenham, in every month of the year, while the latter place is nearly a degree and a half colder than London, in the winter and summer seasons. At the same time it appears, that the annual amount of rain is greater at Bristol than Cheltenham, and much less at London than at either of those places.*

* Dr. POLE'S observations for eight successive years, ending with 1811, were made at 8 o'clock in the morning in St. James's-Square, Bristol. These, compared with the subsequent tables for Cheltenham;—the mean temperature for the year 1808, was found at Bristol to be 46°. The inches of rain 32.8. At Cheltenham, in 1808, the mean temperature was 49°. 7. and the inches of rain 28.53.

The *third chapter* on the saline nature of the soil, is of great importance in the natural history of the place. An opinion long prevailed, that the aperient saline waters came from the neighbouring mountains in a prepared state; but the geological experiments, first published by the author in 1803, demonstrate that the salts impregnating the springs, exist in the strata of the earth immediately surrounding the wells, and that the mineral wells always take origin in a blue marly clay, which contains a great number of different saline matters, combined with the clay, and lying near each other, particularly on the south side of the town of Cheltenham.

But the *fourth chapter*, explaining the nature of the aperient wells, and the properties of their waters, contains the chief subjects of the treatise. It is intended to

relieve the public mind from part of the embarrassment, which has naturally arisen from the sudden increase of wells, apparently with different kinds of waters, issuing from the same spot of ground. The author finding it matter of no small difficulty, to convey distinct information to strangers, concerning so many mineral wells, either anonymous, or known by different names, judged it expedient to add to description, a view of their situation, in a plate at the beginning of the Treatise; which, at the same time, by demonstrating the many new buildings, and recent improvements in different parts of the town, may become acceptable to the community at large.

A BRIEF HISTORY of the origin, and progressive increase of the mineral wells, at Cheltenham, will give the reader a gene-

PREFACE.

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ral idea of the nature of the waters, and will greatly facilitate the means of discriminating between the varieties, described in the subsequent pages.

The discovery of the purging chalybeate took place about a century ago. Mr. Mason, proprietor of a field south of the Chelt, observed that it contained a spring of peculiar character, and that pigeons flocked to the spot, to peck calcareous particles from the blue clay, for the digestion of their food. In the year 1718, he railed it in, and his successor, Captain Skillicorn, in the year 1738, erected an adjoining pump-room, with a dome over the well, ornamented with a pigeon at each corner, and planted the trees of the upper and lower parades, that now form a towering shade against a vertical sun, and one of the most beautiful walks in the kingdom.

This spa soon attracted the attention of medical men, who contributed by their writings, to bring the water into notice; but they differed considerably in their accounts of its impregnations. Dr. Short examining the different wells of Britain, in the year 1740, praised it highly, as an excellent purging chalybeate, taken in doses from one to three pints; and observed that soon after its establishment, it had been recommended by Doctors Baird and Greville.* C. H. Senkenberg, from his experiments made at London in the year 1741, denied that it had any chalybeate properties.† Dr. Lucas remarked, that it contained iron, which invigorated the habit, at the time it proved purgative; and that old men drank it by the quart. Dr. Ruttty obtained 528

* History of Mineral Waters, 2 vols. 4to. 1740, by Dr. Short.

† Philosophical Transactions, 1741.

grains of solid matter from a gallon of water ; and observed that it contained sulphur, together with iron ; and that the dose was from one to three or four pints.* Mr. Barker recommended its use in a prevailing pestilential constitution of the atmosphere.† Dr. Fothergill analysed it, and called it a purging chalybeate which emitted a slightly fetid smell of sulphur, especially after rain.‡ And Dr. Smith repeated the observations of Dr. Short and Dr. Fothergill, that the well yielded 35 pints of water an hour, which was not sufficient for three hundred drinkers ; and therefore judged it proper to point out three causes of scarcity, which ought to be counteracted, viz: Patients drinking it repeatedly at different times

* Rutt's Synopsis of Mineral Waters, 4to. 1757.

† A Treatise on Cheltenham Waters, 1786.

‡ Experimental Enquiry on Cheltenham Waters, 2d Edition. 1788.

of the day, from a mistaken idea of its proving alterative. Sending for quart bottles full to their houses, when a pint only was necessary, And taking too large doses of the water, from an impatience under their diseases.*

The author published his experiments on the waters of the old and new wells, in the first edition of this treatise.† Frederick Accum, esq. chemist, in London, gave a minute analysis of several of the waters of Montpelier wells, with a detailed account of his experiments made on the spot, in 1808. And in this edition, some new analyses are stated by its author,

Our august Sovereign, with his royal family, having drank this water from the 12th

* Observations on the Uses and Abuses of the Cheltenham Water. 1801.

† Dr. Jameson's Treatise on Cheltenham Waters, and Bilious Diseases, first Edition, 1803.

of July till the 16th of August, in the year 1788, on leaving the place, ordered a well to be sunk for the domestic uses of Lord Fauconberg's house, where he resided during his visit at Cheltenham; and instead of fresh water, a saline one was found, of greater strength than that of the original spa. This well, therefore, denominated the King's well, yielded such abundance of water for a series of years, that servants drank it, salts were made from it, and horses were supplied with pailfulls of it, every morning. But this water having gradually failed for a number of years, the well produced so little at last, that it was entirely shut up six years ago.

When the author settled in Cheltenham, in the year 1802, both these wells evidently in a state of decay, were drank out every morning, in an hour and a quarter; and the supply of water was totally inadequate to the

increasing number of visitors. This scarcity, announced in the daily prints, and severely felt by many, who had travelled hundreds of miles to Cheltenham without accomplishing the purpose of their journey, and at the same alarms prevailing among the visitors, that the wells were supplied with water from the river Chelt, determined the author to search for new springs on the south side of the town, a little distant from the old well. Hence, none of the waters, except those of the original old spa, were discovered by accident, but by a series of experiments instituted, to supply increasing demands for water-drinking and native Salts.

After having examined the mineral springs all over the country, and investigated the soil round Cheltenham, by boring in more than forty different places, the author had a well dug in the summer of 1803, eighteen feet

deep, at the bottom of the road leading to Badgeworth, and within a hundred yards of the original spa, from which he got an excellent chalybeate aperient water; but this well yielding no greater quantity than twelve gallons in twenty-four hours, he opened a new one at the top of the same lane, forty feet deep, which afforded such abundance of saline waters, that he obtained leave from Lord Sherborne, then lord of the manor, to erect a new spa upon the waste lands, and published the first edition of this treatise, stating his experiments on the soil, the discovery of new springs, and the certainty of supplying Cheltenham with as much saline water, as could be consumed by any increase in the number of visitors.

A building, erected over Lord Sherborne's well, was opened for the use of the public, in August 1804, and the water soon acquired

a considerable degree of reputation. At this time, several hundred acres of land belonging to the Reverend Mr. De la Bere, adjoining the well, were brought to the hammer, and a general rise of property immediately succeeded.

A great alteration now took place with respect to the mineral wells; Henry Thompson, esq. the largest purchaser of the De la Bere property, immediately directed his attention to digging more wells in the upper corner of the field, now called Montpelier Grounds; and succeeded in establishing several new ones, close to Lord Sherborne's well. Since which, the Reverend Mr. Nash Skillicorn, proprietor of the original spa, opened the Orchard well, which has now obtained an established character; and another has lately been opened at Alstone villa, about half a mile from Cheltenham.

All these wells supply waters with one leading feature, although there is some variety of character in every one of them. They contain a larger proportion of Glauber salts than most other wells in the kingdom, which more commonly derive their cathartic properties from Epsom or sea-salt. But they acquire a variety of other impregnations, from the circumjacent soil containing different proportions of pyrites, sea-salt, and animal spoils, anciently entombed in the valley, by the waters of the boundless ocean. Hence we often find three different waters in the same well; briny at the bottom, sulphurous and chalybeate in the middle, and fresher at the top, according to the difference of specific gravity of the impregnated fluids, and their mode of trickling into the well, from different parts of its sides.

Since the publication of the last edition of this Treatise, new wells have been opened

in fields, considerably distant from the others, hence a new water is brought by under-ground pipes to Montpelier Pump Room, and numbered 5, which proves a valuable addition to the other varieties of waters, as its solid contents are nearly all magnesian salts.

The village of Lemington, two miles from Warwick, and upwards of forty from Cheltenham, has lately come into considerable reputation as a bathing and drinking place; on account of its containing several springs of a strong saline water, so abundant as to supply a great many hot and cold baths. This water has been compared to those of Cheltenham, but the difference is very great. The author on examining this water at Lemington, in the year 1808, found it a great many times stronger of saline matter than any of the Cheltenham waters; but muriate of soda consti-

tuted more than half the solid contents; hence the taste was very pungent, not unlike weak sea water; and although so abounding with saline matter, as large a quantity of water was required for a dose, to operate on the bowels, as of the Cheltenham waters.

The water which most resembles those of Cheltenham, issues from one of the wells at Scarborough in Yorkshire, which is a pleasant chalybeate, and likewise proves purgative in large doses.

THERE is likewise at Cheltenham a species of chalybeate waters, totally different from the aperient ones: the chemical properties and administration of which, are particularly described in the *sixth chapter*.

Thus, in many places about Cheltenham, particularly in the low-lying lands, the soil is intimately blended with oxid of iron, with-

out containing any considerable quantity of saline matter, or pyrites; which has given birth to a different species of water from those already noticed. The first well of this kind was instituted in the year 1803, by the late Mr. Cruickshanks, chemist to the Board of Ordnance, in a field of Mr. Barret's, near the top of the town. Since which, others of the same kind have been discovered; and these simple chalybeate waters have proved of considerable use to invalids, conjoined with a course of the purging chalybeate ones, from which they differ essentially; the author must, therefore, caution strangers not to mistake the one species of water for the other, which he has known to have occurred several times.

The principal water of this kind is at Tunbridge, which is considered the strongest of iron in England. But so uncertain are the

results of chemical experiments upon minute portions of iron, passing numerous filters, that the last printed analysis of this water, demonstrated a very small portion of iron in it;* whereas, seven grains were obtained by F. Accum, esq. from a gallon of the chalybeate aperient, No. 1, at Cheltenham; and the celebrated professor Bergman, got only five grains from a gallon of Pyrmont water, which is the strongest chalybeate in Europe. But the simple chalybeate or steel wells, in Cambray, and above the mill, at Cheltenham, contain more iron than any other waters of this place, without possessing any purgative properties.

The *eighth chapter* on Biliary Diseases, contains an arrangement of those which commonly make their appearance in Britain. It

* Dr. Babington's Analysis of the Tunbridge Waters.

was not without regret, that the author found himself under the necessity of treating their history more medically, than is usual in popular works, but he could not neglect the favourable opportunity of communicating his sentiments upon a subject, which has assumed the utmost importance in modern times.

The author has too frequently observed, at Cheltenham, the abuse of two valuable remedies in Biliary Diseases. Many individuals are in the daily habit of taking *calomel pills* at a guess, and think the practice safe, if they possess the recipe of a physician, who prescribed it on a former occasion; but it is often followed by dangerous consequences. Calomel, without doubt, is one of the most useful articles of the *materia medica* in numerous diseases, and the prejudices of bilious patients in its favour, rest upon the most solid foundations. Mankind, however,

are not generally aware, that its valuable properties depend upon its activity in the human system, and that it cannot be taken in repeated doses, by persons exposed to the uncertain weather of a British climate, without a considerable degree of danger. The occasional use of it, as a purgative, is a valuable part of medical practice. It emulges the bile ducts, and empties the superior portion of the alimentary tube, better than any other cathartic; but the continued use of mercury, brings on an inflammatory state of the body, and by stimulating the secretory vessels in every part of the system, renders the patients extremely liable to get cold, from the usual variations of our atmosphere. In tropical countries, where the weather is uniformly warm, it may be taken every day for weeks or months together; but in this climate, the same habits

would ruin the best possible constitution. The author has known gentlemen in the East Indies take calomel every night and morning, for liver complaints, until they had taken considerably above a hundred grains, without experiencing any inconvenience from it, who could not bear twenty grains in this climate, without affecting the mouth ; which is a symptom that generally renders confinement to the house a necessary expedient, to avoid the danger of getting cold.

The imprudent use of Cheltenham water, even in Biliary diseases, occasioned an eminent Physician, (Dr. Saunders)* to calculate, from observations made at Cheltenham and London, that “ a third of the whole of those
“ persons who drank the aperient waters, was
“ benefited ; one third derived no advantage ;
“ and another third was evidently hurt, by per-

* The Preface to the Third Edition of Dr. Saunder's Treatise on the Liver.

severing in the purging plan." Altho' we do not subscribe to the Doctor's opinion, in its full extent, yet the calculation points at an extensive abuse of this valuable remedy, which, like other powerful ones, requires careful administration. The author of this Treatise has saved many persons from fatal dropsy, by preventing their drinking at the wells, when œdematous swellings appeared in their feet, accompanied with delirium of the absorbent system. It is not uncommon for persons to commence a course of purging, merely, from a supposition that they are bilious; and for those that are really bilious, to persevere in a free use of the waters, without knowing to what extent they can be taken with safety. But prudence requires that invalids should always be directed before they drink the water, whether they are to pursue the laxative, or purging plan, and what kind of waters are best suited to their case. And after they have drank them a certain time,

it would be proper to ascertain with accuracy, whether changes have not taken place in their constitutions, or in their disease, to interdict the further use of the waters.

The *ninth chapter* is intended to give a general idea of the manner the new baths are heated by steam, and to make the invalid acquainted with the different modes of bathing; since there is little doubt but the practice will obtain generally, among the visitors at Cheltenham, when the utility of warm bathing is better understood. The connection between the stomach, alimentary canal, and skin, is so intimate, that the external application of hot water relieves cholics, constipations, and removes spasms from the surface of the body. It also promotes the flow of the biliary secretion, and facilitates the expulsion of gall stones from the ducts.

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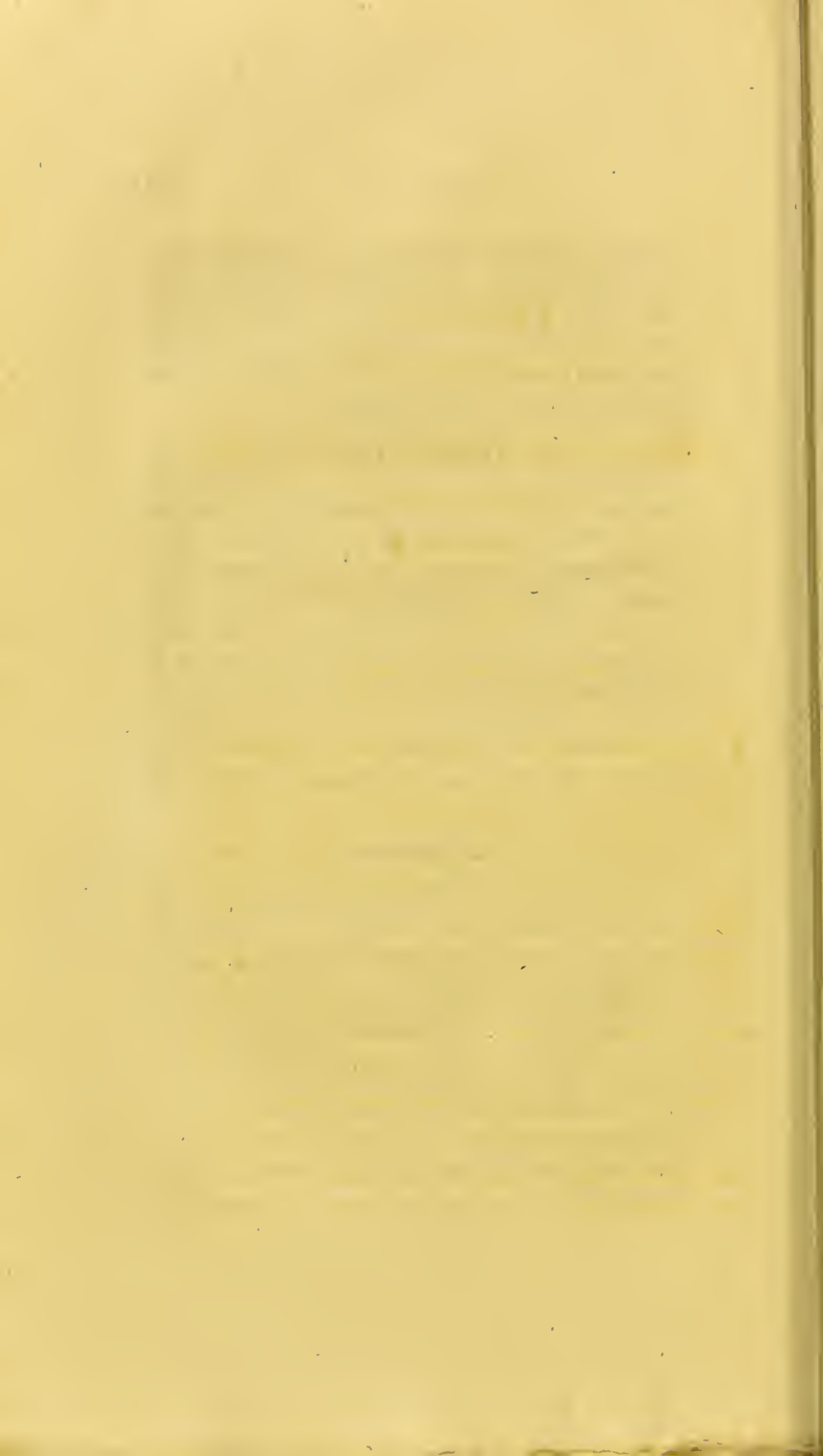
121.....26.....for leucorrhœa, read *leucorrhœa*.

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CHAP. I.

GENERAL OBSERVATIONS

ON

AQUEOUS FLUIDS, MINERAL WATERS AND WATERING PLACES.

SECT. I.

ON AQUEOUS FLUIDS.

THE afflux of rain water to any particular spot, depends chiefly upon the latitude of the place, its exposure, and situation, with respect to winds and seas, the degree of elevation of the land, and the nature of the soil and subsoil which compose its surface.

The ocean is the original source of all waters on the surface of the globe, and fresh water is derived from it, not by filtration through the pores of the earth, but by evaporation, in consequence of the action of the sun and air upon it.

The watery vapours ascending, principally from the ocean, and in a small degree from the land, form clouds in the atmosphere, which are

transported by the winds to the tops of mountains, where they are robbed of their caloric, and precipitated in large drops to the surface of the earth; therefore, winds that blow from the sea over mountains, generally render the adjacent lands watery, and the south-west winds, which bring moisture from the Atlantic Ocean to the mountains upon the western coast, produce the greatest quantity of rain; and the most frequent storms of the Island of Great Britain.

The water thus collected on the terrestrial surface, is returned to the great abyss from whence it came, by means of rivers, flowing from the higher to the lower grounds, and gives birth to the springs and wells upon the plains. The benevolent Creator of the Universe hath therefore supplied every country, of any great extent, with chains of mountains; which are, for the most part, situated near the sea, upon the western boundaries of continents;* and rise steeper on one side than on the other, more effectually to distribute their waters, and to extend their benign influence over the face of the earth. The higher the mountains rear their lofty heads, the more rain they condense; hence there falls dou-

* This proposition is fully established by Mr. Arrowsmith's New charts of the four quarters of the globe; which exhibit the great ranges of mountains situated upon the western continents, near the sea.

ble the quantity of rain at Kendal and Glasgow, on the western coast, than there does at London or Edinburgh, upon the eastern coast, of this island.

The state of the earth's surface has also great effect in augmenting the proportion of its water. Trees bring rain; and clearing a country from its wood, lessens the quantity of its vapour, and permits the solar beams to exert their influence on the land; hence cultivation has always been considered as the best means to render a country dry, as well as warm.

The different dispositions of the soils themselves, to retain or part with their humidity, and render situations watery, is so universally understood, as hardly to deserve attention in this place.

Sand having less attraction for water than any other earth, permits the water to penetrate between its particles, so as to leave the surface of the land dry: and a chalky soil, greedily absorbing water, from its saline nature, is apt to be carried into the earth and appear in the subsoil: whereas, clay forming a chemical union with water, is rendered extremely adhesive and retentive of moisture,* Therefore, soils in general retain a full third of the water which falls on their surface, and permit two thirds to pass un-

* Bergman says clay absorbs ten times more water than sand.

der ground ; but when a tenacious clay forms the subsoil, the vegetable mould is apt to be supersaturated with water, which cannot penetrate through the clay.

While the rain from the atmosphere, flows in the upper strata of the earth, it is fit for the nourishment of animals and vegetables, and becomes accumulated in cavities or wells, which collect water immediately from the strata around them, and therefore are liable to become dry in the summer season; but when rain descends by dykes and vertical fissures to great depth in the earth, it is collected in reservoirs, and returns again to the light of day in a gradual manner, at all seasons of the year. Waters thus coming from considerable profundity, are apt to be mineralized, and less suited for the nutriment of organized beings ; but are thereby prepared by the Author of Nature, for the important purpose of recovering the health of the human species.

Streams of water, passing with great force in the interior of the earth, and sometimes making irruptions upon miners, depend upon the great law of hydrostatics, which always raises fluids to the level from whence they came. The pressure of the atmosphere cannot be excluded from the interior of the earth, which being a porous body, has the looseness of its texture increased by numerous vermin inhabiting, by various

gases escaping from it, and by water dissolving its substance, as well as by the many fissures which naturally exist in its most insoluble and indurated materials.*

SOFT WATER, the immediate product of evaporation from the sea and land, would fall in the form of rain, hail, or snow, through the atmosphere to the earth, in a pure state, if it did not imbibe some particles of extraneous matter in falling through a vitiated air; but from its affinity to most substances in the earth, it comes from thence always more or less mineralized.

It dissolves the adventitious bodies it every where meets with in the storehouse of nature, in a way peculiar to itself. Its elements are not separated, but it unites with them in its entire state; for which reason it is commonly said to dissolve them. Sometimes it combines with substances of the animal and vegetable kingdoms, which are apt to render it putrid; at other times it unites with salts and metals, which mineralize it, and render it hard. It frequently becomes again soft, on exposure to the atmosphere, by immediately depositing these extraneous bodies

* The elasticity of the earth, derived chiefly from its humidity and loose texture, is observable in the rattling of our windows, when a carriage passes at a considerable distance in the street.

which it held in solution; hence the water of rivers, lakes, and ponds, is for the most part soft. At other times, it conveys the mineral salts to a considerable distance, and meeting with matter of new attractions, deposits them in a crystallized state, in the strata of the earth, and in the crevices of rocks, from whence they are taken up by passing rills of water, as shall afterwards be noticed with regard to Cheltenham waters.

All other species of natural waters not formed from rain, hail, or snow, are mineralized; but they are not numerous, for we can reduce them to the following kinds.

SEA WATER, the most plentiful fluid in nature, is also the most useful one. As those minerals which are of greatest utility to the inhabitants of the earth, exist most abundantly near its surface, so sea salt and iron, the elementary principles of most medicinal waters, are the most common of all mineral substances on the surface of the globe; and the human race is instinctively directed by the palate, to the use of that saline matter, which constitutes the thirtieth part of the boundless ocean; on account of its being necessary for the digestion of food, and to prove a stimulus to the excretory organs of the human body. Sea water, besides sup-

plying most of our annual rain, gives birth to salt springs and lakes, and to most of the impregnations of mineral wells. Glauber Salt can be obtained from a combination of sea and Epsom salts, contained so abundantly in the waters of the ocean.*

It receives transparency from the great quantity of earthy salts contained in it. The rays of light pass deeper into it than they do into distilled water, from the density of its particles being increased by the salt. Divers can see at a great depth in the ocean: and sailors often receive warning of the bottom of the sea, when they cannot obtain soundings with a deep sea line of a hundred fathoms. It was formerly supposed, that water took bodies into its pores without increasing its bulk, because it can be saturated with a great number of substances, one after another, without apparent increase of volume; but the Bishop of Llandaff, in his valuable Essays on Chemistry, has plainly proved the contrary. It is a chemical union, which augments both the bulk and weight of the water, in proportion to the degree of its impregnations: hence the specific gravity of mineral waters has always been taken as a criterion of the quantity of foreign matters they contain; making a small al-

* Marine salt is the most universal article of commerce in the world;

lowance for the airs, which are sometimes in such proportion as to diminish their weight. It is this increase of density, from the union of salts, that raises the boiling point of water, according as the solution approaches to full saturation; and renders the mineralized waters more lucid and transparent than the soft ones.

Sea water taken internally proves purgative; but it is not in great esteem for that purpose, on account of the heat and thirst it occasions. It is, therefore, never prescribed in inflammatory diseases, but in those cases of scrofula and debility, which require the combination of its irritative and cathartic powers; hence, also, it has often more effectually removed the tape-worm from the human body, than most other remedies.

PUMP WATERS, collected chiefly from the upper strata of the globe, are rendered hard by the earthy salts they receive from them. An insipid selenite (called *gypsum* by the ancients,) composed of sulphuric acid and lime, proves the most universal of all the causes of their hardness; but it may easily be separated from them, by boiling, as we perceive by their incrustations, which spontaneously take place on the inside of our tea-kettles. By reason of soft waters, abounding more than others with animal and vegetable substances, those which are hard,

have less tendency to putrefaction, are in general clearer than the soft ones, and render vegetables crisp and green by boiling.

Notwithstanding water drinkers prefer hard waters, to those which are soft, on account of their transparency and coolness, they have their disadvantages. They often taste flat, and sometimes produce uneasiness at the stomach, but there is no reason to accuse them of producing chronic diseases, since selenite is so insoluble in its nature, as in all probability to pass by the bowels, without combining with the human fluids.*

PETRIFYING SPRINGS derive their properties from an acid or alkali, dissolving calcareous or siliceous earth in water. These waters suffering decomposition, permit the earthy matter sometimes to be deposited upon the surface of solid bodies, in such a manner as to leave their internal organization intire; at other times, after carrying off part of their fibres, to fill their pores so completely with earth, as to obliterate their structure, and leave only a stone, with the figure of an organic body. Most of our warm waters, as Matlock and Buxton, are of this kind.

Petrifying waters have been reckoned impro-

* Selenite requires 500 times its weight of water to dissolve it.

per for drink, by producing stone or gravel, but the living machine has the power of counteracting every chemical and mechanical property of matter ; so that these waters may be used as common drink, with as much safety as any other species.

THERMAL WATERS are not numerous in this country, and seldom contain much impregnation ; but they are valuable on account of their hot temperature.

Cold springs, which derive temperature from the atmosphere, vary little in the same latitude in different times of the year, provided they be situated deep in perpetual shade, and remain undisturbed by combustion. As their temperature is of a mean between summer heat and winter cold, every degree of latitude produces a degree of difference in the temperature of springs ; hence the amount of annual heat of climate, has been more frequently estimated by the springs of a country, than by any other means.

But the temperature of many thermal springs, exceeds the medium heat of both the atmosphere and the land. The waters of Bath possess from 107 to 116 degrees of heat, as they come from the spring. Those of Buxton, 82 ; of Bristol, 74 ; and of Matlock, 66 ; they must, therefore, derive their heat from combustible bodies in the bowels of the earth.

Many therinal waters proceed from subterraneous fires, at great depth in the earth, which convert the portions of water next them into steam. This vapour penetrating the incumbent strata, is condensed to the state of boiling water, and is accumulated in reservoirs, from which it makes its way gradually to the light of day; and proves of different temperatures, according to the distance it has penetrated.

The waters of Bath have flowed for ages, with undiminished heat, which nothing but subterraneous fires, that burn for centuries, can account for; and, at Iceland the water is ejected boiling hot, in irregular columns, and with convulsive motions, only to be ascribed to the irresistible powers of steam.

The next species of natural waters, the more immediate object of this Treatise, shall have a more particular consideration than those enumerated.

SECT. II.

ON MINERAL WATERS.

THEY partake of impregnations, in addition to those usually contained in pump water, which have given great variety of character to the different wells of these dominions.

They have been usually divided by their chemical properties into saline, chalybeate, and sulphureous waters; but hardly any of them possess a simple character, for they approach each other in a gradual manner, both in the quantity and quality of the ingredients they contain. It might, perhaps, be better to distinguish them by their medical properties; such as, diluent, cathartic, tonic, diaphoretic, and astringent,* which would express their principal effects on the body, a more essential object of consideration, than any scrupulous inquiry into the causes of these effects: because, chemical knowledge must ever be subservient to medical, for the purposes of the human body.

Out of about one hundred and thirty mineral wells in Great-Britain, not more than twenty are much resorted to, or held in great estimation for the cure of diseases, although the greatest number of them might have acquired equal reputation, with the few established ones, had they been brought into use: so much depends upon

*The operation of mineral waters may be medically explained, as follows: *Thermal*, as Bath, Bristol, Buxton, and Matlock, are *diluent* and *diaphoretic*; the sea, Epsom, Newell, St. Chad's, and Bagnigge, are *cathartic* and *diuretic*; Tunbridge is *tonic*; Cheltenham and Scarborough are *cathartic* and *tonic*; Harrowgate, Moffat, and St. Barnard's, are *alterative* and *detergent*; and Hartfel is *astringent* and *detergent*.

situation, and the caprice of fashion, to establish the fame of a watering place. The most noted in England are, Bath, Tunbridge, Cheltenham, Scarborough, and Harrowgate, which are much crowded in summers, by tourists and votaries of pleasure, as well as by invalids. The resort to these places, and to the sea-side, has become general, since every fishing town on the coast, has its subscription libraries, ball-rooms, and billiard-tables. These numerous visitors, and the return of the families of members of parliament to their mansions, the circuits of law-officers, and the migrations of landscape painters, nearly strip London of its inhabitants every summer and autumn.

The IMPREGNATIONS of mineral wells are not very numerous. They do not exceed forty, and no mineral water contains more than eight or ten different ingredients, half of which have no salutary action on the human body, as far as we know; but taken in the aggregate, they are of great importance in the cure of diseases. One or two always give the water its principal character; but the effects of several ingredients collectively, are different from what could be expected from the knowledge of their virtues singly. For instance, the operation of Cheltenham waters upon the bowels, is much easier,

and more powerful, by the union of the Glauber, Epsom, and common salt, contained in them, than could be experienced from a solution of any one of these salts, taken in a larger proportion than the aggregate of the three. Bodies are so changed in their properties by new arrangements, and chemical analysis is so intricate a subject, that it is doubtful whether we are acquainted either with the entire ingredients, their accurate proportions, or the state of their combination in any mineral water yet examined. The author has had frequent opportunities of observing many different results, in the number and quantity of impregnations, from the analysis of Cheltenham waters, by chemists of first-rate abilities, from all parts of the kingdom. This is, perhaps, the chief reason why mineral waters, drank in their native state, are more effectual in the cure of diseases, than the most skilful imitation of the chemist's art can possibly make them. The following impregnations are of most consequence, as articles of the materia medica.

GASES, of various kinds, are contained in natural waters, either in a combined or loose state. In their loose state, their affinity for water has less force than their elasticity, so that it is with difficulty they can be retained in it. They fly off by alteration in the pressure of the atmos-

phere, or by the smallest increase of its temperature; and both barometrical and thermometrical observations are required, to ascertain the relative quantity of airs in waters. The following are most commonly found in mineral wells.

Oxygen Gas, (pure vital air,) exists in some waters in an inconsiderable quantity, but it is incompatible with iron or hydrogen gas.* It adds to the stimulating and exhilarating powers of the water upon the animal system.

Atmospheric Air, exists more or less in every species of water, except that which is newly obtained from the still; animals could not otherwise live and breath in the sea and rivers, nor would they immediately die by immersion in distilled water; but its proportion seldom exceeds the 18th part of the water.

Carbonic Acid Gas, (fixed air,) so abundantly produced from lime stone, every where in the earth, exists in almost all waters. It unites with the earths and metals, as a weak acid. Some waters contain more than their own bulk of it; and when superabundant, it gives the water a sparkling appearance during its escape. It is the only gas whose medical properties in water, have been duly ascertained. It acts as a saline substance in promoting the secretions;

* Thompson's Chemistry, Vol. iv. p. 188.

but it is apt to produce giddiness and head-ach; when the water contains it in excess: which effect is so great at times, as to prevent the patient from taking a full dose of the water. As a grateful acid, it has long been employed, in a separate state, to check vomiting, and to obviate putrescency of the system.

Sulphurated Hydrogen Gas, (hepatic air,) formed by the decomposition of pyrites and water, abounds in particular springs, known by the name of hepatic or sulphureous, especially those of the thermal kind. Water is capable of absorbing this gas in a larger proportion than its own bulk, but it gradually separates from the water, or becomes united with an alkaline or earthy basis, and the hydrosulphuret of lime is the most frequent ingredient of hepatic waters. It possesses many of the chemical properties of acids, and it precipitates metals, by the hydrogen abstracting oxygen from them, while the sulphur combines with the metal.*

Taken internally, it acts powerfully on the

* The incompatibility of the existence of sulphurated hydrogen gas together with metals in water, does not apply to iron; for it unites with the oxyd of iron, and forms a hydrosulphuret, which may remain a considerable time without precipitation in water, as is particularly the case with some of the Cheltenham waters.

skin, and kidneys, although the operation on the body has not been well explained. It has been employed with greatest advantage in the cure of cachexies, to kill worms, and either externally or internally used, to cure cutaneous diseases.

Azotic or Nitrogen Gas, (mephitic air,) produced from the decomposition of animal substances or atmospheric air, exists in some springs, particularly in the Buxton and Harrogate; but it has such feeble adhesion to water, that it cannot be retained in it; hence, in passing off, it increases the sparkling appearance of the water; there is little reason, however, to regret this volatility, since we are not acquainted with any salutary properties, that it exerts upon the human stomach.

SALTS exist in all mineral waters. Indurated bodies, which, in their simple state are of an insoluble nature, unite with water, by means of oxygen or carbonic acid. A law of chemistry is, that every substance must be converted into the nature of a salt, before it becomes soluble in water. Thus magnesia, in its pure state, is insoluble; but when united to carbonic acid, it readily combines with water. Another law is, that bodies only unite chemically with one another, in determined proportions; thus,

iron is rendered soluble, by acquiring a portion of oxygen ; but it becomes again insoluble, by an excess of the same principle : and these laws explain a great many of the phenomena of mineral wells.

The Salts are in a state of concentration in the waters ; for the saline matter obtained from their crystals, amounts to little more than half the quantity of the same salts obtained by evaporation to dryness ; saline matter taking up nearly an equal bulk of water in forming crystals, has often led to inaccuracy in stating chemical experiments, sometimes performed by evaporation, and at other times by crystallization.

The Sulphuric Acid, formed from sulphur ; and *the Muriatic Acid*, from sea salt ; have both great avidity for water, but are never found in it alone ; because they always meet with alkalis or earths, to which they unite themselves and form neutral salts.

Soda, (fossile alkali,) the offspring of sea salt, is a common ingredient of waters ; but it is generally united to a mineral acid in them. It is sometimes found in hot mineral waters, combined merely with carbonic acid.

Sulphate of Magnesia, (Epsom salt,) obtained for commerce from the bittern of sea

water, is the most common of all the perfect salts in springs, except sea salt; for most cathartic waters contain some of it. It acts on the human body as a brisk and easy cathartic, and also operates by perspiration or urine, according as the skin is kept warm or cool; but it gives the water a bitter and nauseous taste.

Sulphate of Soda (Glauber's salt), the combination of sulphuric acid with soda, is the most valuable ingredient of purging springs; but it predominates only in a few. It is a brisk and easy cathartic, which proves more grateful to the palate than sulphate of magnesia.

Muriate of Soda, (sea salt,) is found in almost every water that percolates the earth, and being generally associated, in small quantity with the two former salts in springs, it in some degree, meliorates their taste, and increases their purgative powers.

Three saline earths are found in mineral waters, viz.

Calcareous Earth, (lime,) the most important of all the earths to organic nature, is the most common one. It exists generally in waters, and is usually held in solution by an excess of carbonic or sulphuric acid. It has a greater tendency to load the stomach, than to prove a remedy for the cure of diseases.

Magnesian Earth, (common magnesia) exists in the greatest number of springs, and is a useful purgative. The carbonate of magnesia is almost always accompanied by carbonate of lime.

Aluminous Earth, (pure clay,) is found in a few springs, in the state of alun, by combining with an excess of sulphuric acid. There is but one well of this kind in reputation in Britain, which is that at Moffat, in Scotland. Many others might be found, if the water could be used internally in diseases. Eight years ago, the author examined one at Wardrew, near Gilzland in Cumberland, of an austere taste, and strong astringent nature. The country people were in the habit of resorting to it for the cure of ulcers, by external application. A well of this kind has been lately discovered in the Isle of Wight, and is acquiring reputation in the cure of diseases.

METALS are seldom found in mineral waters, except iron. Copper, very fortunately, exists only in water near copper mines.

Carbonate of Iron abounds in mountainous and marshy situations; and carbonated chalybeates, the most common of all kinds of mineral waters, are easily discovered by their inky taste, and ochry channels, and by exhibiting

a shining pellicle on their surface. The iron is generally suspended in waters by carbonic acid, although in a few instances it is held in solution by sulphuric acid, as in alum waters.

The attenuation of iron is not less remarkable in water, than the extraordinary effects such a minute portion of matter has upon the human body. A pint of Tunbridge water does not contain a grain of steel, and yet every portion of the water can be changed to a dark colour, by a drop or two of tincture of galls. In like manner, the same small portion of iron taken internally in a pint of water, for a few weeks, constricts and hardens the fibres of the human body. It is therefore employed as a tonic in weak, lax, pale habits, and in chlorotic and cachectic diseases.

Various muriates, nitrates, and other mineral bodies are found occasionally in springs, besides those enumerated, as well as some small portions of animal and vegetable matters in a few waters, but they do not give them a medical character, and are for the most part accidental ad-mixtures.

The DILUTING PRINCIPLE, or the watery menstruum of mineral wells, the only one common among them, is perhaps the most important of all their properties, as well in a medical as in a

physical point of view. Numbers of facts might be adduced in proof of this. The Matlock water, issuing from the rocks of Derbyshire, and the Malvern water, are distinguished for being the clearest waters in England, with little impregnation. Bath waters are said to brace the stomach, although they are hot, and contain so little iron, that it cannot be weighed by the accuracy of chemical experiment. We observe daily in medical practice, that the oxyd of iron administered in doses from two to ten grains, has less effect in curing diseases, than the third part of a grain, taken in the minute state of division in which it exists, largely diluted in mineral waters. The strongest saline springs contain little above a dram of purging salts in a large dose of water, and yet this produces greater effect upon the body, than three times the quantity of the same salt, dissolved in a small portion of common water.

In a Treatise published by the author many years ago, upon Diluents,* the salutary effects of simple water, and the operation of the fluid principle upon the human body, were fully explained. It was then observed, that in the healthy state, liquids were necessary for the

* Dr. Jameson's Treatise on Diluents, and the operation of Fluids upon the Human Body, 1788.

digestion of the aliment, and well calculated to lessen the effects of acrimonious matter in the stomach ; to fit the chyle to pass the lacteal vessels ; to give fluidity and mildness to the blood ; and to carry off its saline particles, by the different outlets of the body. In a diseased state, they rendered the small vessels permeable, promoted the secretions, and carried off every putrid and acrimonious principle, generated in the body by diseased action of the vessels. It is by dilution chiefly that we can explain the reputation of many waters and decoctions, which contain the medicating properties in so small a quantity, that their bulk must be of more importance than any specific principle they contain : since the same good effects cannot be obtained by a much larger dose of the same medicine, united with a smaller portion of water.

It was a doctrine of the celebrated Dr. Cullen, that all mineral waters acted on the system nearly in the same way.*

“ Almost all kinds of mineral waters, whether chalybeate, sulphureous, or saline, have been employed for the cure of scrofula, and seemingly with equal success and reputation ;

* Cullen's first *Lines of the Practice of Physic*, vol. iv. page 376.

“ a circumstance which leads me to think that
“ it is the elementary water that is the chief
“ part of the remedy.”

The late Mr. John Hunter was in the habit of prescribing a large tumbler of cold pump water, to be drank before breakfast every morning in cases of schirrus and cancer, and no other internal remedy.

Besides these effects of the aqueous principle upon the body, the minute state of division, with which chemical bodies are united to water, renders them more diffusible over the human system, and more salutary in the bowels, than grosser substances. The effect of the increase of the surface of bodies by minute division is remarkable in quicksilver, which may be swallowed, in its entire state, to the quantity of several ounces at a time, without producing so great an effect upon the body, as two or three grains would do, when it is minutely triturated with the most innocent substances.

The TEMPERATURE of waters occasions a great difference in their character, and is therefore of importance in the cure of diseases. This is a strong argument in favour of mineral waters being drank on the spot, independent of all other circumstances. It is a property of all mineral springs, sheltered from the sun, to

be uniform and steady in their temperature. They are colder in summer, and warmer in winter, than all other waters, except the sea: which explains the appearance of smoke hovering over springs in the winter season, in consequence of their warm vapours being condensed by the colder state of the atmosphere.

As cold liquids brace the stomach, and warm ones tend to produce general relaxation, the colder mineral waters in the generality of diseases, are drank in the summer season, the better. But, in many cases, where people have not been in the habit of taking large draughts of cold fluids, they should not at first drink them in their coldest state, without caution: on the contrary, in those cases, where relaxation of the body is wanted, it is necessary to drink them hot. Hence has arisen the reputation of many thermal waters in the cure of gout, rheumatism, and biliary calculi.

SECT. III.

WATERING PLACES.

THESE hold forth many advantages to invalids, besides the impregnations, and other properties of their wells. The author has, therefore, long considered the subject of mineral

waters as unfairly represented to the public. Treatises, without number, have been written upon the chemical properties of wells, which could have no other effect than to display the knowledge of their authors; others have been written upon the medical virtues of particular springs, to prove that they cure all diseases by the supernatural powers of their ingredients: whereas, the truth is, the good effects arising from a resort to watering places, depend neither upon the chemical nor medical properties of the springs alone: for a variety of other circumstances operate in conjunction with the waters in the cure of diseases. All kinds of mineral waters drank upon the spot, prove efficacious in curing diseases, although it is well known that some of them have no more impregnation than common pump water. The great number of cures performed by drinking the *Malvern*, *Buxton*, and *Bristol waters*, which contain very little foreign matters, clearly demonstrate that their salutary effects depend on several circumstances, acting in conjunction with the impregnations of the waters; which I shall now endeavour to enumerate separately.

Change of air is the cause of many cures performed at watering places. Merely removing persons with chronic, or obstinate diseases,

from one place to another, even if the air to which they are shifted be not so pure as that which they breathed before, has always been considered by the faculty to be of the utmost importance in the cure of diseases; and we have daily proofs of cures obtained in this way, after all other remedies have failed. But when the change is made from a less pure to a more pure air, the chance of recovery must be greatly increased. The author has seen many patients who were in a state of langour, and passed restless nights in London, recover their appetite and sleep almost immediately on their arrival at Cheltenham, from the stimulus of the fresh air.

When we consider that London, in winter, is encompassed with a cloud of carbonic vapour from the chimnies,* and with fogs from the drains, and the river Thames; that its atmosphere in summer is filled with the dust of stones, straw, and horse-dung, and rendered oppressive by reflected heat from brick buildings, and stony pavements; we cannot be surprised that its inhabitants endeavour to prolong the span

* The dark cloud, composed of unburnt smoke, continually suspended over London, led the celebrated Count Rumford to attempt a calculation of the immense number of chaldrons of coals, always floating in the atmosphere.

of their existence, by laying in a stock of health from the purer air of country situations, in the summer season.

Impure air seldom arises from the soil itself, unless where there are stagnant marshes. On the contrary, new ploughed ground has been long recommended for the cure of diseases, because it has the property of absorbing all kinds of putrid effluvia from the atmosphere, for the purpose of nourishing vegetable bodies : hence it is, that putrid substances prove the best manure. It is large assemblies of breathing animals—combustion of fires and candles—and masses of putrid substances, where there is no soil to absorb their effluvia—which contaminate the air of cities, and render it necessary for the valetudinarian, and for people with tender lungs, to take refuge in the country.

The effects of odours on the nerves and brain, occasioned Dr. Cullen to observe, in his *Treatise on the Materia Medica*, that those vegetable perfumes which emitted the strongest effluvia, were the most powerful antispasmodics. He therefore gave the preference to assafœtida and musk in curing diseases ; and I have but little doubt, that perfumes of the agreeable kind, are extremely friendly to the human frame, and that the odour of a flower garden, new cut hay,

or bean fields in blossom, may produce tranquillizing effects on the nervous system.

As sudden vicissitudes of temperature are neither safe to the health of the human body, nor congenial to the feelings of the skin, rendered irritable by heat, or by long residence in warm climates, the benevolent Author of Nature has placed the seasons of the year in gradual succession, and removed the hot and cold countries so distant from each other, as to render transitions from one to the other, safe to the human frame; yet new comers, from the tropical countries, find it necessary to season themselves to the cold of Britain in a still more gradual way, by taking shelter in the warm atmosphere of Bath in winter, and in the salutary air of Cheltenham during the summer season.

Exercise in the pure air is another advantage which watering places afford. Very few watering places are in esteem, which are unprovided with either variegated walks, or pleasant rides; and when exercise is moderate, regular, and general, it increases the vigour and health of the human system. It produces an equal generation of animal heat, and stimulates the living powers to perform their functions, and to remove the causes of diseases. But the exercise

should be of the most agreeable kind, and that which employs the greatest number of muscles; therefore, riding on horseback is to be preferred in most cases; especially in company with agreeable companions. It agitates the trunk of the body, which is of the greatest importance to the health of the machine; and it draws out the mind of the patient from the consideration of his disease, by an attention to the numerous objects around him; both of which circumstances are essential for its most salutary effects.

Occasional relaxation of mind is as necessary for the health of the body, as it is for the happiness of the human species. Continued anxiety has great effect in exhausting the powers of life. In many cases, it brings on diseases; and in others, it destroys the chance of recovery, which particular situations or remedies would otherwise accomplish. It has been found by experience, that transition from home to scenes of a new and pleasing nature, generally has the effect of emancipating the mind from the cares of life, as well as of removing the body from the fatigues of business. Watering places generally furnish various kinds of amusements, which the inhabitants are solicitous to multiply in every way they can; and the libraries supply entertainment in the sultry part of the day, when

exercise cannot be taken with pleasure or advantage.

Regular habits of life have great effect in preserving and restoring health. Many gentlemen, who are in convivial habits at home, find it necessary to shake them off by an excursion to the country, for the benefit of their health. Sobriety prevails at Cheltenham, from the force of example, as well as from the advice of the faculty, who always recommend temperance and exercise, as necessary accompaniments to a course of the waters. Ladies, who commonly go to bed at eleven or twelve o'clock at night at watering places, and rise at seven or eight o'clock in the morning to walk to a mineral well, must find it much more conducive to their health, than their habits of late hours in the crowded assemblies of the metropolis, or the neglect of the pure stream of vital air, which exhales so copiously from the vegetable kingdom in the morning.

Confidence in a remedy is a principal step towards the cure of a disease. There is a tendency in the human mind to attribute virtues to natural remedies, which it supposes cannot be supplied by art; and to none more than to springs, which have been held in veneration

from the earliest times. The expectation that waters will do good after other remedies fail, is attended with the best possible effects to the patients. Hope must be kept alive in the human breast ; and the sensible qualities, of saltness, temperature, transparency, and sparkling of mineral waters ; together with the observation of the crowds of people who derive benefit from them, contribute greatly towards the salutary effects they produce. If they had no bad taste or smell, patients would have no confidence in their virtues, and without faith they could not be made whole : because they would not continue long enough in the use of the waters, to give them the fair chance of performing a cure.

CHAP. II.

THE SITUATION OF CHELTENHAM, SALUBRITY OF ITS CLIMATE, AND LONGEVITY OF THE INHABITANTS.

THE town is situated $94\frac{1}{2}$ miles, by the Uxbridge road, W.N.W. from London, in the centre of many opulent towns, which increase its prosperity, and afford the invalids who visit it, an opportunity of performing pleasant excursions, in the intervals of drinking the waters.*

* Taking Cheltenham as the centre, the bearings and distances of the chief towns from it, by the turnpike roads, according to Cary's County Map and Itinerary, are as follows:

Gloucester	.....	$9\frac{1}{2}$ miles	S.W.
Bristol	.....	$44\frac{1}{2}$	.... S.W.
Bath	.....	$44\frac{1}{2}$	.... S.S.W.
Monmouth	.....	35	.... W.S.W.
Worcester	.....	25	.... N.N.W.
Malvern	.....	22	.... N.W.
Tewkesbury	.....	9	.... N.W.
Oxford	.....	40	.... E.S.E.
Cirencester	.....	16	.... S.S.E.
Evesham	.....	16	.... N.N.E.
Warwick	.....	44	.... N.N.E.
Winchcomb	.....	7	.... N.E.
Birmingham	.....	51	.... N. and by E.

The number of settled *Inhabitants* in the town, when the general Survey was made by order of Parliament, in 1801, amounted to 2,639. But so rapid has the increase been, from the influx of tradespeople, and from its having become a winter residence for genteel families, that the population of the town, independent of visitors, was in 1804, estimated at 5,000, and the dwelling houses in the town at 634. The number of male inhabitants under sixteen years of age, according to the returns for the militia about the same time, was 2,307, for the whole parish; therefore, by allowing an equal number of females to males, and half the population to be under twenty years of age, the statement was considered within bounds.

The increase in the number of *Visitors* was equally rapid; for so far back as the year 1780 they were estimated at 374; in 1790 at 1,100; in 1802 about 2,000; in 1808 at least 4,000; and the last season cannot be reckoned less than 6,000. In consequence of this sudden augmentation, more than one hundred new buildings were annually added to the town for the three last years. But the rage for building has now greatly subsided, notwithstanding the population still continues to increase, and all the houses to be filled in the summer and autumnal seasons.

According to the last *Census*, taken in May, 1811, by order of Parliament, there were 8,325 inhabitants in the small parish of Cheltenham, of which the population of the town was more than four-fifths, including a very few of the visitors' servants, who were taken as militia-men.

HOUSES.			FAMILIES.			OF ALL AGES.		
Inhabited . . .	Not Inhabited,	Building, . . .	In Agriculture,	Tradesmen, &c.	All others . . .	Males,	Females.	Total,
1,568	109	127	383	722	641	3,780	4,545	8,325

We cannot be surprised at this rapid increase, when we consider the advantages of the situation—the salubrity of the climate—the various public amusements—the opportunity of drinking the waters—the conveniency of hot and cold baths—the pleasant walks and bridle rides near the town—the picturesque views—the well-furnished new houses—the clean, well-lighted streets—the numerous visitors from all parts of the world—and the goodness of provisions; which are generally on a par with the prices at Bath, Bristol, and Gloucester.

The *Climate* has considerable diversity of character, in situations little distant from each other, owing to the natural division of the county, into the Cotswold or hilly country, and the valley.

The Cotswold Hills, extending about twenty miles into three counties, is separated from the east part of the parish of Cheltenham, by a semi-circular range of secondary mountains, less than three miles distant from the town. Most of them are cultivated from their bases to their summits, where they become diversified by numerous farms, and extensive sheep pastures. They are composed generally of limestone, red sand stone, free-stone, and grit, and in particular places of argillaceous slates, all disposed in beds of horizontal strata, intersected by vertical fissures. On two or three, which have their summits fractured facing the southwest, and also very often in the centre of the mountain, numerous marine shells of different species are discovered, intimately blended with their most indurated materials.* The stones from their quarries, which resemble those of Bath, are used for the foundations and ashler fronts of houses, and are so perfectly calcareous, that they burn into good lime for building.

* Chiefly Entrochytes, Belemnites, Ostracites, Nautilites, and Gryphites.

These mountains, elevated 340 yards above the bed of the Severn, have a climate colder by two degrees of latitude, than the valley. They are thereby disagreeably cold, and frequently windy for six months of the year; but in hot weather they afford the visitors of Cheltenham an opportunity of taking refreshing rides, and they supply enchanting prospects of the rich and fertile valley beneath. The summit of Cleeve Hill, a quarter of a mile from Bernard's Cross, was one of the stations for carrying on the Trigonometrical Survey of Britain, by Major Mudge. It is elevated 1,022 feet above the level of the sea, and commands very extensive views of ten or twelve counties. In clear weather, Warwick and Coventry, as well as Gloucester and Worcester can be seen, and with good glasses, the people may be discovered walking at Great Malvern on the face of the Malvern Hills, twenty-two miles distant. The atmosphere of these elevated lands is pure, and the longevity of the inhabitants fully equal to what we find it in the valley.

The valley of Evesham, now more frequently called the valley of Gloucester, is not excelled in beauty and sylvan scenery by any spot whatever, and receives vivacity from the Severn winding in its centre, and embellishment from

the numerous rural villages, and plentiful orchards, which every where adorn its surface.

The Forest of Dean, a part of the valley separated by the Severn, is covered with venerable forests of naval timber, and enriched by coal and iron mines, as well as by many valuable quarries of grey and red grit-stone. These low-lying lands near the Severn, were formerly considered as unhealthy situations, but since they have been drained, their climate is not less salutary than that of the other parts of the valley. Indeed, the whole vale has a pure atmosphere, and has ever been famed for the longevity of its inhabitants. But the town of Cheltenham is peculiarly distinguished, for the salubrity of its situation, and for the utility of its climate to invalids from tropical countries, for reasons which are now to be explained.

The consideration of *Winds* is of first importance, in determining the nature of climate in every part of Britain, on account of its insular situation, and the following are the most general circumstances respecting them.

Easterly Winds, generally blow over the island from the end of February to the beginning of June, with only a few days intermission at a time, but they prevail more on the East than on the West coast. They likewise blow easterly

for a few days, about the time of the Autumnal Equinox. They veer to both sides of the East point, but the N.E. prevails most frequently; and this wind coming from the snowy mountains of Lapland and Norway, brings a cold, dry, and dense current of air, which proves extremely noxious to all organized bodies. It parches the human skin, and occasions an inflammatory state of the system, which brings on rheumatisms, intermittents, eruptive diseases, and severe cattarrhs. It contracts the vessels of plants, and drinks up their moisture, which render them sickly, and expose them to the attack of numerous insects. It is so greedy of moisture, that it raises fogs, in passing over the surface of waters, and divides the fluid particles of the atmosphere, so as to produce continued dribbling rain instead of heavy showers, when blowing from the S.E.

Westerly Winds, generally blow more than eight months of the year, most commonly from the beginning of June to the end of February, and prevail particularly upon the West coast. They veer to both sides of the West point, but continue longest in the South-West.

Mountains and Headlands, not only change the direction of winds, but they also regulate the temperature and humidity of circum-

jacent countries. Accordingly, near half of the clouds evaporated from the sea, in passing over the mountainous chain which extends along the West coast of Britain, is precipitated near the shores, and the other portion is dispersed over the rest of the island, so that the South-West wind supplies most of the annual rain, gales of wind, and thunder storms of this kingdom.

The wind South-West, brings heat and moisture from the Atlantic ocean, which destroy the density, and healthy elasticity of the atmosphere. But the wind due West, or veering a point or two to the North of West, is generally clear and dry, and brings with it the finest balmy weather of Britain.

The wind due *North*, seldom blows thirty days in the whole year, and coming from the polar regions brings a cold, dry current of air, dense to the Barometer, which braces and invigorates the human system. Although the weather be generally dry with a north wind, when it happens to rain with the wind in that quarter, it for the most part, continues to fall in small drops a considerable time.

The wind due *South*, seldom blows five weeks in the whole year. By proceeding from the middle regions of the globe, it brings a warm,

moist, and rarified atmosphere, light to the barometer, by which means it disengages the effluvia of odorous bodies, produces heavy rain, and debilitates the human system.

These are the states of the weather existing generally over the island, but they are frequently modified by local circumstances, which depend upon particular states of the earth's surface.

The first and most important peculiarity in the site of Cheltenham, is its vicinity to the Cotswold hills, which are of such moderate height as not to abridge the length of day, and sufficiently elevated, to screen the town from the destructive influence of the bleak East, and cold North East winds, that prevail all the spring of the year, and after the Autumnal Equinox. It is likewise distantly bounded by the mountains of Wales to the West, and the rocky shores of the Bristol Channel to the South West, which have also some influence on the nature of the climate. The valley being open only to the West, and South West points, occasions the West wind to assume a peculiar cold character at Cheltenham, which in most other places is warmer, and blows in gentle zephyrs. Deprived of its heat in passing the tops of the Welsh mountains, scarcely forty miles distant, it

glides along the valley between the hills, producing a sensation of cold nearly equal to that of the East wind. This wind is therefore disagreeable in winter, more especially when veering north of West; but as westerly winds prevail most in the hottest season of the year, they are, upon the whole, pleasant and salutary breezes.

At the same time, this funnel shape of the valley, with a large river in its centre, elicits currents of air, which ventilate the atmosphere, and contribute largely to the purity and salubrity of the climate. The melioration of climate, from the shelter of the Cotswold hills, in the form of an amphitheatre around Cheltenham, induced the late Benjamin Bell, Surgeon of Edinburgh, distinguished by his writings and extent of practice, to send his consumptive patients to Cheltenham, from an idea that the climate was as mild as that on the coast of Devonshire, and less frequently disturbed by boisterous weather.

The author has always observed, that the inhabitants of Cheltenham are little subject to winter coughs, notwithstanding the great number of aged people in the town, and likewise that epidemics which rarely appear, do not prevail any great length of time.

The following table is extracted from two years meteorological journal, kept by the author at Cheltenham, and the observations were taken with the thermometers on the outside of the windows, in a northern aspect, and completely excluded from the direct influence of solar rays. Sixs's thermometer, which denotes the greatest cold and heat in the observer's absence, was employed for the tables, but the common thermometers indicate nearly the same mean temperature of the twenty-four hours, if the observation be taken between nine and ten o'clock in the morning.

As the greatest expansion of the mercury in the barometer is not considered to be above three or four hundred parts of an inch from heat, it is of less importance at what hour the remarks are made with this instrument, if it be recollected, that in general it is rather higher in the mornings and evenings than in the middle of the day; and the greater height of the barometer, so frequently observable in spring and summer, than in the other parts of the year, arises from the elasticity of the atmosphere, together with its actual weight, being greater at those particular times.

METEOROLOGICAL TABLE.

	Thermo- meter	Baro- meter.	Rain.		Snow	Wind.				Thun- der.
YEAR 1808.	Monthly Mean.	Monthly Mean.	Number of Inches.	Rainy Days.	Snowy Days.	No. of Days Westerly.	No. of Days Easterly.	No. of Days due North.	No. of Days due South.	Number of Storms.
January,	37.2	29.69	80	8	3	29	—	—	2	—
February,	37.8	29.80	20	4	3	22	7	—	—	—
March,	40	30.30	03	2	3	2	28	—	1	—
April,	46.5	29.71	5.05	10	2	20	6	3	1	—
May,	57	29.73	1.30	11	—	25	4	—	2	2
June,	60	29.80	5.20	9	—	20	6	1	3	—
July,	66.2	29.78	2.50	14	—	14	14	—	3	3
August,	63.8	29.73	3.05	10	—	21	4	4	2	—
September,	56.5	29.62	3.20	13	—	11	11	3	5	3
October,	49.1	29.66	3.90	14	—	23	2	3	3	1
November,	46	29.61	2.60	10	—	12	14	—	4	—
December,	36.5	29.75	70	5	8	19	7	4	1	—
Annual Mean for 1808.	49.7	29.78	28.53	110	19	218	103	18	27	9
Annual Mean for 1807.	50.1	29.73	27.05	96	18	213	96	25	30	5

The *Temperature* of the climate has often been canvassed by strangers. Some considering Cheltenham as extremely cold in winter. No doubt the elastic air of an open country town, aided, occasionally, by the diminished heat of the west wind, must be colder than the confined atmosphere of cities, loaded with the vapour of chimneys, and of human beings ; but this is a pure state of inhalation, which contributes to the longevity of the inhabitants, as might be illustrated, by numerous instances of asthmatic people selecting Cheltenham for their winter quarters.

Others have complained of the intensity of the summer heat, but the author observed, that the mercury did not rise in the thermometer above 86° at Cheltenham, during the uncommon hot days, the 13th, 14th, and 15th of July 1808, whereas it exceeded ninety, on the same days, in many other towns, and was as high as 93½ at the Royal Societies House in London.

These, and other considerations, determined him to institute a comparison of thermometrical heat, for the winter and summer months of Cheltenham, with those of London ; but it could not be done from the registers published in the Monthly Journals, through the want of correspondence in the hours of observation, and from

the latter not being taken at the hottest and coldest times of the diurnal revolution.* The author therefore applied to the late Mr. Gilpin, Register of the Royal Society, for the mean temperature of night and day in London for the year 1808, as indicated by that invaluable instrument, Six's thermometer, who supplied him with every information he wanted, in a very obliging manner, and it thereby appears, from the comparison of mean heat, that London is near a degree and a half warmer than Cheltenham, both in the winter and summer, excepting a few days in June and July, which are hotter in the middle of the day at Cheltenham, than at London.

* In London the greatest cold of the 24 hours is found to be at 8 o'clock of the morning, in December and January, and at 7 the rest of the year : and the greatest heat a little after 2, noon, all the year round ; which occasioned the publication of the Royal Society's observations at these hours ; but it has not been ascertained, whether the same thing takes place in the country as in London.

A COMPARATIVE TABLE,
OF
MEAN DIURNAL HEAT.

	Days.	1807. Dec.	1808. Jan.	1808. Feb.	1808. June.	1808. July.	1808. Aug.
Cheltenham	1	33	43	45	58	61	68.5
London		36.5	45	50	61.5	61	66.5
Cheltenham	2	38	40	48	57	59.5	64.5
London		40	44.5	50.5	58.5	60	67.5
Cheltenham	3	33	38.5	42.5	58.5	60.5	63.5
London		35.5	38	43.5	58.5	62.5	65.5
Cheltenham	4	44	34	38	57	60	63
London		41.5	37.5	37	59.5	60	67.5
Cheltenham	5	42.5	44.5	44	57	58.5	66.5
London		44	44.5	44	58.5	58.5	69
Cheltenham	6	40	40	43	54.5	59	69
London		40	44.5	44	54	62	70.5
Cheltenham	7	32.5	44	46.5	54	63.5	67.5
London		35.5	45.5	49	58	66.5	66
Cheltenham	8	32	44.5	40	54	64	67.5
London		29	45	41	57.5	66.5	69
Cheltenham	9	31	42	38	54	63	67
London		30	43.5	36	56	66	66.5
Cheltenham	10	26.5	44	32	55	62	66.5
London		29	46.5	32	57.5	66	66
Cheltenham	11	36	44	36	57.5	66	64
London		32	56.5	34.5	60.5	70	67
Cheltenham	12	38	36.5	26.5	58	69.5	63.5
London		40	38	30.5	58.5	76	67
Cheltenham	13	40	36	28	58	77	67.5
London		41.5	40.5	28.5	62	80	65
Cheltenham	14	40	44	25	58.5	75.5	65
London		43	44	27.5	63	81	66.5
Cheltenham	15	30.5	28.5	23	57	75.5	64
London		36	32	23	61.5	72	65.5
Cheltenham	16	34.5	23	36.5	57	74	62
London		39	29.5	37.5	57.5	75	63.5

A COMPARATIVE TABLE,
OF
MEAN DIURNAL HEAT.

	Days.	1807. Dec.	1808. Jan.	1808. Feb.	1808. June,	1808. July.	1808. Aug.
Cheltenham	17	33	28	38	59.5	70	63
London		33.5	31	35	61	72	65.5
Cheltenham	18	34	20	40	59	68.5	60
London		35	31	42.5	68	73.5	65
Cheltenham	19	34	34	36.5	63.5	69.5	63.6
London		36.5	35	38.5	67	76	66
Cheltenham	20	32	34.5	40	64.5	66	64
London		31	39.5	35	68	68	64
Cheltenham	21	30	22	34	67	65	64
London		30	26.5	34.5	64	67.5	67
Cheltenham	22	28.5	38	36	65	64.5	65.5
London		32.5	25.5	36	63.5	66.5	66
Cheltenham	23	24	38.5	36.5	62.5	65	64.5
London		34	31.5	36	62.5	70.5	62.5
Cheltenham	24	30.5	38	35.5	62	65.5	61
London		38	38	38	62	70	64
Cheltenham	25	30	36	34	63.5	65.5	60
London		40.5	37	34.5	63.5	67	63
Cheltenham	26	48	30.5	33	66	66.5	64
London		47	31	33.5	64.5	66.5	64
Cheltenham	27	45.5	32	40	63	65.5	62
London		47	34	43	62	67.5	63
Cheltenham	28	48	42	42.5	60	66	58.5
London		41.5	42.5	41.5	57	62.5	59.5
Cheltenham	29	49	37.5	49	64	67.5	59
London		49	39.5	49	64.5	68.5	61.5
Cheltenham	30	41.5	44		66	60.5	59.5
London		44	45.5		62	69	67.5
Cheltenham	31	45	46			68	60.5
London		42.5	51			70	62.5
Monthly							
Mean for Cheltenham		36.3	37.2	37.8	60	66.2	63.8
Ditto for London		37.9	38.8	38.3	61.1	68.3	65.5

The quantity of *Rain*, is what might naturally be expected from the central site of Cheltenham, between the East and West coasts of the island, there being more than falls on the Eastern, and less than on the Western shores. It appears by the Reverend Mr. Blanchard's tables, that thirty inches and three quarters of rain fell in 1806, and thirty-one inches and three quarters in 1807, for twelve or thirteen towns equally situated upon the East and West coasts;* but other authors have reckoned thirty-two inches and a half to be the mean for the whole island.† There generally falls at Kendal on the West coast, above fifty inches, and sometimes as much as seventy or eighty in the year, and at London, on the East coast, according to the Journals of the Royal Society, there fell in 1807, (which was an uncommonly dry year,) only fourteen inches and one-fifth of rain, and the number of rainy days were ninety-one; and in the year 1803, eighteen inches and a half, with one hundred and twenty-eight rainy days, although in many years it amounted to twenty-two inches or more. Mr. Gilpin observed a circumstance which has never been explained, that more rain falls by three or four inches an-

* Tilloch's Philosophical Magazine for May 1807.

† Thomson's System of Chemistry, vol. iv. p. 180, and the 4th vol. of the Manchester Memoirs.

nually, within two or three miles of London, than is collected at Somerset House.

The author is of opinion that the difference in the annual amount of rain at Cheltenham and London, depends upon the showers being heavier, particularly in the night, from the greater proportion of trees and vegetation in the country than in towns; for there is very little difference in the number of rainy days, in these two places.

The *Wind* has always been considered by the author, as the leading circumstance of climate and weather, for the rise and fall of the mercury in the thermometer and barometer generally follow the changes in the direction of the wind; but most observers in London are deprived of the opportunity of registering it correctly, from the particular situation of that extended city; and the author has not yet had an opportunity of making any comparative observations of the wind, with those in the Table for Cheltenham.

As *Evaporation* is always proportioned to the extent of watery surface exposed to the action of the sun and air, it cannot take place to any great amount at Cheltenham, where there are no morasses nor stagnant pools, and only a small rivulet on each side of the town, with ra-

pid currents to the Severn.* There are therefore seldom any thick fogs, but the author has seen several dark days called blight, and also a slight haziness in the early part of the day, occurring several times in the year.

The many shrubs and trees, which ornament the valley, are neither so lofty, nor so thick, as to prevent the soil from receiving the beneficial influence of the sun and air, but are sufficiently numerous to exhale an abundant proportion of watery vapour from their surface. This moisture, however, is more than counterbalanced by the quantity of vital air they yield to the action of the solar rays upon them, which contributes largely to the salubrity of the climate.

The adjacent country is far from being a dead flat, since to the North, the East, and South of the town, the surface is beautifully variegated with gradual ascents, and gentle declivities. In short, the town may be considered as resting upon the base of the Cotswold hills, for the water has a considerable descent in its progress from Cheltenham to the Severn, which passes through Gloucester and Tewkesbury, in the

* The river Chelt, rising above Charlton King's, passes on the South side, and Wyman's Brook rising out of Prestbury Hill, near Hewlit's, passes on the North side of the town, in their course to the Severn.

centre of the valley. It was ascertained a few years ago by Mr. Dadford, engineer, employed in a plan to bring a canal from Tewkesbury, that Cheltenham was elevated above Gloucester 165 feet; above Comb's Hill, half way to Tewkesbury 132; and above Tewkesbury itself, 143 feet.

The soil around Cheltenham, in some places, consists of a brown or blue clay, which are wet in winter, but it must in general be considered as rather a dry soil, especially in situations containing a great quantity of calcareous matter. The greatest part of the town is built upon a keen sand, and the streets become dry in half an hour after heavy showers of rain; but the roads in the vicinity of the town are pulpy and wet, not from uncommon humidity of climate, but from their being made with the soft calcareous stones of the neighbouring mountains, and cut up by heavy loads of coal and building materials. This inconvenience has lately been greatly obviated, by the construction of a Railway to Gloucester, which facilitates the importation of Bristol stone from the river Severn, to render the roads hard and durable.*

* *Vide* the plate of the town fronting the title, for the situation of the Railroad, which closely accompanies the new turnpike road to Gloucester.

The *Longevity of the Inhabitants* is the best possible proof of the salubrity of the climate of Cheltenham, of which some idea may be formed, from the following list of all persons, above 20 years of age, recorded on the tomb-stones in the church and burial-ground of that town, taken by the author in the year 1807:

Burial stones.

From 20 to 40 years of age	195
40 to 60	211
60 to 80	396
80 to 90	47
At 90 and above it	15
<hr/>	
Total	864

This longevity can scarcely be exceeded in any country. More than half the number was above 60 years of age, and 15 out of 864 persons attained the age of 90 and upwards; which is one above 90 years of age in every fifty-seven persons; and nine to six of these were women, which favours the opinion, that females live longer than males, although fewer of them arrive at the utmost extent of human duration.

The result was little different with the author's enumeration of the tomb-stones of the Anabaptist chapel at Cheltenham. The same

similarity also occurred at the church-yard in the village of Prestbury, a mile and a half from Cheltenham, except that there [were two persons buried there above a hundred years of age, and one woman living in the workhouse a century old, who is since dead.

But the climate will not altogether account for the great extent of life so observable in the parish of Cheltenham, the hereditary stamina of the body, and the customs of the people, must also be taken into consideration.

With respect to the town, it consists chiefly of one open and clean street, and the lower classes have separate tenements, so that no accumulation of carbonic acid takes place in the air, from respiration, putridity, or smoke, in consequence of dense population. The people in general are robust, and in habits of exercise in the open air, for there are no manufactories, and few sedentary employments, in or about Cheltenham. The inhabitants of the town and its vicinity are chiefly farmers, gardeners, builders, labourers, and shopkeepers. Even the visitor and shopkeeper, as well as all other classes of the community, are much in the street; and the town lying N.W. and S.E. the sun crosses the street about eleven o'clock, so that, (excepting three-quarters of an hour,) the houses afford the pavement a shade all the

day, against the scorching rays of the sun, in the hot season of the year.

The lower classes of the people have little anxious care for the maintenance of their families, and exhibit great indifference about employment. They can live a week upon four or five day's work, and are therefore slow, and leave off out-door work when it rains. Their diet is wholesome, and the vegetables, bacon, and mutton, are uncommonly good and plentiful. The people eat moderately of animal food, and drink freely of home-brewed ale and cyder, but little of spirituous liquors, and are seldom much intoxicated. They have regular hours for sleep, for they go to bed about ten o'clock, and rise early in the morning. The farmers and most of the cottagers in the vicinity, are cleanly in their houses and persons, and the same may be said generally of the inhabitants of the town.

It is perfectly obvious, that such habits, with the aid of a salubrious climate, will not only contribute to the preservation of the human system, but will also beget a strength of stamina, which must be transmitted from father to son, and, in a series of successions, render longevity the inheritance of particular families, a circumstance extremely frequent in the valley of Gloucester.

CHAP. III.

THE

SALINE NATURE OF THE SOIL.

THE soil of the parish of Cheltenham, in some places, consists of a loose sand, and in others of a brown or stiff blue clay. The soil of the town, and its immediate vicinity, consists of a surface stratum of brown mould, three or four feet thick; next, a keen hard sand, penetrating six or eight feet deep, and then a quick sand or loose gravelly matter, from which the springs of pump water issue. This gravelly stratum is always found nearly at the same level, although the super-incumbent matter may vary in thickness, from ten to twelve feet on the north, and much less on the south side; the gravel extends four or five feet deep, and rests upon a concavity in the blue clay, which forms the rising ground on each side of the town. But a peculiar circumstance of the valley, and more particularly of the parish of

Cheltenham, is, that the soil, in a great number of situations, is composed of immense beds of marly blue clay, which extend to a great depth under the surface, and become hard and laminated like soft slate, as they deepen. A great variety of fossil shells and pyrites are found in this kind of blue clay at different depths; and in many places white particles of calcareous powder, and crystals of selenitic salts, from which the aperient springs of Cheltenham and its neighbourhood, derive their origin. This kind of soil, therefore, becomes of considerable importance in the natural history of the place.

An opinion has long prevailed, that the saline springs in the vicinity of Cheltenham extend in one direction through the valley; to refute which, it will be sufficient to give the following brief result of the author's visit, in 1803, to wells of this description, in almost every different situation.

The *Hyde* spring, in the parish of Prestbury, two miles and a half from Cheltenham, and one from the village of Cleeve, consists of a purging water, which was strongly recommended by Dr. Linden, in the year 1750, as equal in efficacy to that of the Cheltenham spa. It is a saline water, resembling those of Cheltenham in taste, and exhibiting the same kind of appear-

ances by chemical tests. It never was brought into general use for drinking, but great quantities of salts were made from it, during a series of years, by the late Mr. Ironmonger, surgeon. It is now used only to cleanse the milk-pails, and other utensils of the farm.

In *Cleeve Field*, near Gotherton, about four miles from Cheltenham, and three to the northward of the Hyde spring, there is a well about four feet deep, full of highly-coloured water, exposed to the atmosphere. It is a weak brine spring, containing a large proportion of common salt.

At *Arle*, upwards of a mile from Cheltenham, on the south-side of the public road, there is a spring of purging water, which rises in a ditch. Dr. Short described it in the year 1740, to be a bitter purging water, as strong as that of the Hyde, but not so clear. This water greatly resembles those of Cheltenham, but scarcely so strong, and is altogether neglected.

At the village of *Walton*, about seven miles from Cheltenham, and one from Tewkesbury, there is a well, which contains a purging water, at the depth of 20 feet. The late Dr. Johnstone of Worcester, described it in the year 1787, as possessing a sulphureous smell, and containing some iron. He observed, that it sometimes

occasioned giddiness of the head, and usually acted like Cheltenham water upon the bowels.

At the seat of Robert Morris, Esq. near the village of *Barnwood*, eight miles from Cheltenham, and one and a half from Gloucester, is a saline well, which was discovered in the year 1802, on digging in blue clay, so hard, as to require blowing up with gunpowder. It contains a greater proportion of common salt, to that of the Epsom or Glauber, than is found in the other wells of the vale, and a pint or two proves cathartic.

At *Nanton Farm*, nine miles from Cheltenham, and half a mile from Todington, on the Tewkesbury road, there is a draw-well, which contains a great quantity of saline water. It has been noticed above forty years; and salts were attempted to be made from it, but they proved too black for use.

Although the water was tasteless at the top, on sinking a bottle thirty feet deep, it brought up water which emitted a strong smell of sulphur, and tasted brackish. A quart proves purgative, and it turns black by boiling in metal vessels. It is never used at the farm in the hot season, when the water is low, on account of its saltiness.

At *Walsworth Hall*, the seat of Mrs. Hayward, three miles north of the city of Gloucester, there is a spring, which, fifty years ago, was resorted to on account of its saline impregnations, but it is now only used as a watering place for cattle.

At the village of *Stoke Orchard*, four miles from Cheltenham, near the Tewkesbury road, a draw-well, forty feet deep, contains saline water which tastes salt, without either iron or sulphur. A pint proves purgative, but it is only used for washing the farm utensils, which it preserves sweeter than any other water.

Behind the house of Mr. Sealy, at *Alstone*, a mile from Cheltenham, is a well, seven feet wide and sixty-one deep, which contains a strong saline water, without iron or sulphur, and a great proportion of sea salt.

The author found that all these saline waters in their native state, afforded the same kind of precipitations, with chemical tests. With the tincture of galls, they changed in less than twenty-four hours to a greenish-coloured fluid, with a shining variegated pellicle on the surface of a bluish cast, like that on the surface of chalybeate waters, and a dark brown sediment at the bottom. With acetite of baryte, more or less of a white precipitate was produced; with

oxalic acid, a white powder; with pure ammonia, a white precipitate and film adhering to the glass; with nitrate of silver, a bluish sediment; with nitrate of mercury, a white sediment, changing to yellow; with equal quantity of alcohol (of the specific gravity of 0,830) they dropped a white powder; and when added in large proportion to the water condensed by evaporation, they deposited slender crystals. Which experiments I considered demonstrative of the presence of sulphuric and muriatic acids, of lime and magnesia. In short, that selenite, sea, Glauber, and Epsom salts, or their elementary parts, exist in the soil surrounding these wells, and that rain or hard water percolating through the tenacious blue clay, received impregnations from them, but of no great variety.

The Town, lying upon a bed of sand, is plentifully supplied with common pump-water; and springs are every where found at the depth of from ten to eighteen feet, which are hard waters, without containing sulphur, iron, or perfect salts, and are fit for every domestic use.

But on each side of the town, North and South, there are rising grounds at the distance of a quarter of a mile, and not exceeding a hundred feet at the greatest elevation. The soil of these eminences consists of a blue clay or

marl, which dips, from within a foot or two of the surface of the land, in one continual stratum, to unknown depth, and supplies all the aperient waters.

The circumstances most observable in this clay are, its growing dryer and harder, the deeper it penetrates, so as to appear in some places indurated, and foliated like slate. It is nearly as hard as stone at great depth, and sounds hollow when struck with the borer. Ligneous and vegetable productions are seldom found in it; but in one of the high fields some black strata were dug from great depth, which burnt freely, and had all the appearance of coal; circumstances, which confirm the opinion of some miners, who visited Cheltenham, that there are beds of coal at great depth, on the south side of the town, but that they would not pay the expence of working.

When the author dug a well five feet wide, and eighteen deep, near the original Spa, wherein water of a saline, sulphureous, and chalybeate nature was found, he subjected the various matters of the soil, and the water contained in it, to chemical experiments.

The CLAY exhibited a blue colour, and a smooth tenacious texture. It adhered to the tongue, and tasted insipid. It was so indurated

as to appear glossy, like polished marble, upon being cut with a knife. When dry, the colour became a little brown, and the texture brittle. It was studded with glittering crystals of salts, distinctly seen with the naked eye, about the size of peas; and with the microscope, in the sun, the salts were discovered to be blended, with brown oxyd of iron and blue clay, into one common mass.

The clayey mass effervesced strongly with vinegar, indicating the presence of earthy carbonates; and in many situations abounded with powdery particles of lime. For these reasons, the inhabitants use it as a manure for the land, and reckon it unfit to make bricks.

To ascertain the proportion of saline matter that the clay contained, a solution was made of a hundred grains of dried clay in one ounce and a quarter of dilute muriatic acid, and the liquor filtered from it. The dried residuum was boiled ten minutes in six ounces of distilled water, and filtered again; the remaining insoluble portion, after drying, weighed only 53 grains; which shewed that the clay had lost nearly half its weight. How immense then must the quantity of saline matter be, in so many acres of blue soil on the south side of Cheltenham? The remaining argillaceous earth had lost none of

its blue colour. It was unflammable, contracted in the fire, with a crackling noise, and consisted of alumine, some magnesia, and a little silex.

The SHELLS were the remains of marine animals of different species, buried at all depths in the soil, some entire, others in fragments; and when dissolved, had left the impression of their form upon the clay. Some possessed all the original characters of shells, with lineaments expressed in the most perfect manner. Others consisted chiefly of indurated clay and a crystallized matter, the colour of horn, in the form of shells. Many of them were Marcasites, exhibiting a beautiful argentine and brassy lustre externally.* And a few were composed internally of brown pyrites. These extraneous matters, in their fluid state had filled the cavities of the shells, and afterwards became indurated, while the calcareous matter gradually changed its appearance.

* The Alchymists considered Marcasites as stony matters, receiving colour from different metals; and they distinguished them into gold and silver species. The term is used at present nearly in the same sense as Mundic, for the first rudiments of a metal; that is, a mineral containing fewer metallic particles than constitute an ore. The term is often applied to shining fossils, whether they contain metal or not.

The species of shells, dug from the blue clay on both sides of the town, consisted of numerous gryphites, entrochytes, belemnites, ostracites, and nautilites.

The *dentalia*, or tusk-shells, were very numerous, and always compacted with hard clay. But the *cornua ammonis*, called snake stones, were the most abundant of the whole. They generally consisted of four spiral and tapering convolutions, rolled in a circle like a coil of rope. They exhibited striæ on the back, with regular ridges between, and internal chambers, which were petrified with blue clay or pyrites. This species afforded a beautiful variety; for they possessed different degrees of metallic splendour, and were of all sizes from a silver penny to a crown piece, and some few treble the last size. Their chemical composition consisted of lime, carbonic acid, and the extraneous matters before enumerated.

The PYRITES, (sulphuret of iron,) were mostly in oval masses, frequently as large as walnuts; at other times, in flat patches, with a smooth shining surface and brassy appearance, and generally of a pale yellow colour, denoting the species to be sulphuret of iron, formerly called martial pyrites. They were so hard as to scratch glass like a diamond, and to strike

fire with steel. They were brittle, and the fracture discovered metallic fibres converging to the centre. The specific gravity was 4.5. at a temperature of 60° ; and when the sulphur was dissipated by roasting, they lost near half their weight. The remaining metallic matter being dissolved in diluted sulphuric acid, deposited a fourth part of its weight, on adding prussiate of potash.

The native SALTS were generally found equally dispersed in the clay near the surface, and proved to be crystallized selenite, which wasted by exposure of the clay to the weather. They had a transparent sparkling appearance, and a texture softer than alabaster. They were mostly of a flat or cubical shape, but sometimes found in tuberculated masses larger than peas, as if the confinement of the soil had obstructed their crystallization. Their taste was insipid, or rather sub-astringent, and their solubility in fluids extremely difficult; but when reduced to powder, and exposed to a strong heat to expel the acid, they became a white friable powder, soluble in water. This solubility, together with the undisturbed transparency of the solution, by adding pure ammonia, shewed the base was not magnesia; and the white precipitate produced by adding oxalate of ammonia, were suf-

ficient evidences of its being lime. The acid was discovered to be sulphuric, by acetite of baryte producing a deposit of sulphate of baryte, by the solution of the crystal in a large portion of water.

The ARTIFICIAL WATER obtained by boiling the clay, and that collected naturally in the openings of the ground, were compared in the following manner. A pound of clay, taken from the borings in the lane, was boiled in a gallon of rain water for half an hour, to dissolve the salts; and the liquor filtered. The clay liquor had a salt taste. The boiling had separated the gases and iron, but decompositions of the water were produced by the different tests, which shewed the presence of lime, sulphuric acid, muriatic acid, magnesia, and soda.

The NATURAL WATER tasted salt, and with the tests, exhibited the same appearances as the clay liquor; and the former being in possession of its air and iron, turned milky with lime water, and red with vegetable juices; and changed to dark green, or purple, with the powder and tincture of galls. Half a gallon of the natural water, evaporated to dryness, afforded three hundred grains of residuum, and by evaporating twelve gallons to a pint and a half, upon

cooling it in a shallow vessel, twelve ounces of beautiful large crystals an inch long, of the shape of six-sided prisms, with dehdral summits, were obtained; which salts were soluble in three pints of water, at 60 degrees heat. These indicated the greater abundance of sulphate of soda, than of the sulphate of magnesia or muriate of soda; which latter would have disposed the crystals to assume a cubical form, and would have required a greater quantity of water to dissolve them.

From the whole of these experiments, the author made the following general deductions, and published them in 1803, when the nature of Cheltenham wells was little understood; and have since been amply verified by the general practice of digging wells.

1. That the lands on both sides of Cheltenham consist of immense beds of blue clay, their bases forming an intermediate valley, upon which, the sandy soil of the town rests. This clay does not generally contain crystals of salts, but they never have been found in any other soil than this kind of marly blue clay: and chiefly near the surface, on the south side of the town.

2. That this clay is of so tenacious and indurated a nature, that little water can penetrate

through it, unless some change of stratum, fissure, or accidental aperture, from decomposition of chemical substances, permit it to pass. And as none of the wells have been dug beyond the blue clay, the supply of water cannot be so rapid, as with other springs which percolate looser materials, or rise with force from considerable profundity.

3. The native salts, or their principles, exist in the soil immediately surrounding the wells, and the water which dissolves them, comes from the rain falling on the surface. These wells cannot, therefore, interfere with each other at any great distance; and the strength of their waters must vary according to the state of humidity in the earth, particularly when the wells are not deep.

4. That both the clay liquor, and natural water of these experiments, discovered the same kinds of impregnations, as the old Spa did in its original state, and that the proportion of saline matter was equally abundant in them as in the established wells; since a single pint of water from the opening in the lane, operated upon the bowels of several persons who drank it.

5. That the decomposition of blue clay, shells, pyrites, and sea salt, relicts of the ancient

ocean, give origin to the impregnations of all the aperient waters of Cheltenham, and most probably in the following manner.

The *soil* furnishes magnesian earth, and the clay is rendered blue by muriatic acid. The *shells* supply calcareous matter, and carbonic acid, and they appear to change first to a radiated horny substance, and afterwards to the crystals of selenite, already described.* The *pyrites* are changed by the action of air and water to a saline nature, and give birth to sulphuric acid, hepatic gas, and chalybeate principle. It being well known to chemists that oxygen united to the sulphur of pyrites forms an acid, which reacts upon the iron; and the water being decomposed by the iron in this state, hydrogen gas is let loose. Hence volcanic phenomena have frequently been initiated, by burying iron filings and sulphur moistened with water in the earth. The *sea salt* supplies muriatic acid, and the soda of that salt united to the sulphuric acid from pyrites, forms the Glauber salt of these waters.

6. That a sufficient supply of aperient saline water may be had at Cheltenham for any possible consumption, since nearly the whole soil south of the Chelt, contains more or less of these

* The author has several specimens of these substances in different states of change.

saline substances. And little more remains to be done, than to select the fittest situations to establish new wells; since most of them will yield more or less water, at the depth of from fifteen to ninety feet, impregnated with saline matter.

CHAP. IV.

THE SITUATION, ANALYSIS, AND PROPERTIES, OF THE APERIENT SALINE WATERS.

ALL the Aperient Wells are *situated* on the South side of Cheltenham, within the distance of a thousand yards from the little river Chelt, which runs parallel with, and close to, the town; and the simple Chalybeate Wells are likewise established, in the low alluvial lands adjoining the same stream.

The WELLS supplying aperient water, are all found in calcareous blue clay, forming the eminence on the south side of the town, which rises from the Chelt to an elevation of sixty feet; and its verdant surface is intersected, by the lane leading to the village of Badgeworth, which divides the property of the new Wells, from that of the old Spa. [*V. Plate I.*]

The wells have so greatly encreased in number within a few years, that the author can reckon not less than thirty-four in use, either for drinking, or for the manufacture of salts;

hence a consequent diversity of waters, which, together with a changeableness in some of their properties, have deterred chemists from attempting a complete analysis of the whole.—The author, however, has attempted an arrangement, upon general principles, and has not neglected to state all the circumstances hitherto discovered, as well chemical as medical, which serve to distinguish the several varieties.

Almost all mineral waters have been first brought into notice from their experienced effects upon the human body; and it is now well understood, that these depend upon the universal watery principle, together with some collateral circumstances, which contribute to their celebrity, as much as the solid contents of the waters. Chemical investigation, the usual consequence of their discovery, can therefore only give an imperfect knowledge of their virtues. It becomes, however, an indispensable means of enquiry, to obviate the fancies of some invalids, concerning a remedy proceeding immediately from the hand of Nature, and to quiet the apprehensions of others, directed to the consumption of a fluid in such large quantities.

Chemistry is certainly more usefully connected with this branch of science, than with most others. It enables mankind to imitate the waters, with a tolerable degree of accuracy, when

they cannot be had in the native state. It improves their knowledge of the soil and its mineral contents, in exploring the origin of the waters. It discovers the associations, proportions, and properties of minute portions of matter with so much precision, that the causes of the specific differences of mineral waters, and the variation of their principles at different times, can be readily determined. And it assists the faculty in explaining many of their actions upon the human system.

But to enter into the consideration of all the minutiae of perfect analysis, and of the proportions of the inferior Salts contained in the different waters, would involve us, unnecessarily, in the most intricate problems of chemistry, and prove incompatible with the purposes of a practical treatise, intended for the public at large. We shall, therefore, proceed to consider the general principles of the waters, and state the several circumstances of their taste—decomposition by re-agents—constituent parts—and effects upon the human body,—as the most certain means of distinguishing between the different species; we have also taken advantage of some of the late estimations of Kirwan, who has pointed out a new and more direct mode of analysis, than formerly employed.*

* Kirwan's Essay on the Analysis of Mineral Waters, 1799.

These shall be stated in a plain way, that Gentlemen who amuse themselves with experiments on the waters or their salts, may find little difficulty of ascertaining every important shade of difference between them, and that invalids may acquire satisfactory knowledge of the nature of the waters they are using as a remedy.

I. CARBONIC ACID GAS.

It is contained in considerable quantity, in all the aperient waters of Cheltenham fresh from the pump, in a free state, besides the portion combined with their salts and iron, as their briskness, and escape of air-bubbles on shaking, evidently denote. Cold water can absorb its own bulk of this gas by long contact, without imparting to it any smell or TASTE. But at a temperature of 80° it gives the waters an acidulous taste, and sparkling appearance.

The best *Tests* for judging of their saturation with this acid, are their reddening the infusion of Litmus slightly, and dropping a white precipitate with lime-water; and these effects not taking place after the waters have been boiled, prove that it is no other acid than the carbonic. The waters of Cheltenham, freed from this loose acid, never discover any excess of alkali to the taste, nor did the author ever find them change the

test papers to a brown or green colour. On the contrary, he always observed white curdy flakes copiously produced in them, by a solution of soap, although he has certainly detected a minute portion of Carbonate of Soda in some of their Salts.

The *Constituents of this Acid* are 28 parts of carbon, and 72 of oxygen.* The author generally collected over mercury, about 8 cubic inches of it from a gallon of boiling fluid, upon an average of the different species of aperient waters. But its elasticity renders the quantity extremely variable even in the same water, at different times, since it escapes from them by exposure to the atmosphere in open situations, or by sudden encrease of temperature. Even the portion holding the Iron and Salts in solution, is driven off by boiling, which occasions the precipitation of these substances.

The Medical Virtues it imparts to the waters are extremely various. Besides the antiseptic and diuretic properties it possesses, in common with other acids, it acts upon the nervous system, in producing in some persons exhilaration of spirits, and in others drowsiness and sleep. But the uneasiness and distension of the alimentary organs it is also liable to occasion,

* Lavoisiers Elements of Chemistry, by Kerr, p. 103, 1773, 2d Ed.

when the waters do not pass off freely, are troublesome symptoms, difficult at times to counteract.

II. THE NEUTRAL SALTS.

They are contained in all the waters, and may be classed into three species, according as the Sulphate of Soda—Sulphate of Magnesia—or Muriate of Soda,—predominates in them. One of these salts always gives them a leading character, as may readily be discovered by their taste, and operations upon the human frame. They may exist singly, or united in the same water; but all the other saline contents associated with them, (except the Iron and Sulphur to be separately considered) are contained in such insignificant proportions, as to add nothing to the value of any of the waters, since we have reason to believe their medical virtues would be the same, if they possessed no Sulphate or Carbonate of Lime,* nor any Muricates of Lime and Mag-

* Sulphate of Lime (or Selenite) is found in small proportions in all the Cheltenham Waters, as well as in common pump waters, but we know not its use. Its Lime may be immediately precipitated by oxalate of Ammonia, after gently boiling them. And as this Sulphate requires 500 times its bulk of water to keep it in solution, it is deposited by greatly concentrating the fluid, or by adding spirits of wine, for which it has a greater sensibility than any other Salt.

nesia. But at the same time, that a few grains of these salts in a gallon of water can have no medical operation, they are apt to adulterate the other salts, and to render their crystals deliquescent and difficult to dry.

As the two principal salts of Cheltenham waters are neutralized by the same acid, they will be best distinguished from each other by the denomination of their different bases, which communicate remarkable properties to them.

1. The *Alkaline Waters*, in which Sulphate of Soda prevails, are by far the most numerous at Cheltenham. The four first numbers at Montpellier pump room, and the waters at the original spa, are of this kind. These may be distinguished from the other kinds, by the alkaline or urinous *Taste* of the waters, not unlike a weak solution of common salt, but leaving a slight impression of bitter in the mouth.

Chemical *Tests* likewise afford distinctive characters of these waters. The pure alkalies do not produce a precipitate with them, like those containing magnesian sulphate, for notwithstanding several different kinds of salts, fully saturated, co-exist in Cheltenham Waters, we seldom find any other perfect one, except Muriate of Soda, associated with the Sulphate of Soda in this particular species. A solution

of Barytes is the best test of the acid; and a simple and expeditious mode of analysis has been lately adopted, viz. to apply the tests as long as a precipitate ensues, and to estimate the quantity of salt from the weight of the precipitate. Hence, when the Selenite is previously removed from the water, if we add Nitrate of Barytes until all the sulphuric acid is precipitated, 170 grains of the Sulphate of Barytes, will denote a hundred grains of dried Sulphate of Soda, or 238 grains of the crystallized Salt.*

But the *Crystals* of the Waters, afford by much the best means of judging of the difference of their aperient Salts, as well as of their quantities, when obtained with care and accuracy; since we get them from the unerring hand of Nature in their most perfect condition, and separate states, in consequence of their different solubilities, and times of crystallization. The average amount of the crystals of Sulphate of Soda, obtained from several of these waters, was about .280 grains in the desiccated state, for every gallon, when the crystallization was carried on to the smallest portion of water, and the refrigeration to near the verge of freezing; besides 30 grains of Muriate of Soda, and some earthy precipitates. But a difference in the quantity, as well as in the appearance of the

* Vide Kirwan on Analysis, p. 210.

Salts, may be somewhat varied, by a difference of strength in the waters, at different seasons of the year—the quantity of fluid employed in the process—the slowness of the evaporation—and the attention paid to the admission of the atmosphere. They are, however, always of the same nature and essence; the opinion, therefore, that they are a Sub-sulphate of Soda, cannot be maintained.

The Crystals of this salt are always perfect neutrals, the definite proportions of their constituent principles being 24. 5. parts of Sulphuric Acid—19. 5. of Soda—with 56 parts of water ;* and the foreign bodies they take up in the water of crystallization, or that adhere to them, may be separated by repeated dilutions; and crystallizations. They form in the shape of six-sided prisms, the larger with plain faces, and the smaller channelled, with dihedral summits like the Glauber Salts of the shops, which appears evident as well to the naked eye, as by the measurement of the angles, of their most perfect crystals, with the Goniometer. But they are usually of larger dimensions than common Glauber Salts, as they greatly exceed an inch in length, and are nearly as thick as they

* These proportions are given by Dr. Wolfaston, in an admirable paper, printed in the Philosophical Transactions for 1813

are long, which must arise from the modes of operating upon large quantities of water.

Like common Glauber too, they require 2½ times their weight of water, at a temperature of 60° to dissolve them, and are not so soluble even in hot water as the Magnesian Salt, which renders their solutions more liable to deposit their salt on cooling. They deliquesce in a hot temperature, and are fusible in red heat; the water of their crystallization is in such a weak state of combination, that they are extremely efflorescent on exposure to a dry air, without loss of properties; hence the minute particles, by losing their water, become a dry white powder, not half the weight of the original crystals, and consequently, an equal quantity in solution operates with twice the strength upon the human body.

That the *Medical Virtues* of these waters are important, appear from the present state of the practice of physic; since saline laxatives, alkalies, and bitters, which produce effects upon the alimentary canal, similar to those of the Waters of Cheltenham, are in universal use for chronic diseases. But all their saline particles do not pass off by the bowels, they also act in conjunction with the bulk of fluid upon the other secretory organs, since they either increase the flow of urine, or promote insensible

perspiration. They are less nauseous than the Magnesian Waters, and milder in their operation as laxatives.

2. The *Magnesian Waters* contain a magnesian base combined with sulphuric acid, commonly called Epsom Salt, as their chief saline impregnation. They are found only in three or four newly discovered wells, in a differently impregnated soil from that of the alkaline waters; and the water No. 5, at Montpelier pump-room is of this kind. They are distinguished by a less saline, and a more bitter *Taste*, than the former sulphate. Their impression on the tongue is so mild and soft, that we can scarcely at times, discover by the palate any medicating property in them, except the bitter.

Pure Ammonia, fresh and strong, is the best chemical *Test* of these waters, especially when the carbonic acid is previously separated by boiling them. It produces the precipitation of magnesia, re-soluble by adding a few grains of citric acid. Oxalic acid has little effect on magnesia, whereas it precipitates the lime instantly. An accurate method to precipitate the magnesia without any other earth, is, to add to the concentrated fluid a solution of Carbonate of Ammonia, fully neutralized by exposure to the carbonic acid of the atmosphere. This will

occasion no decomposition until some solution of Phosphate of Soda, or Phosphoric Acid, be also added, a copious precipitate then takes place, and 100 grains in the desiccated state, indicate 19 of Magnesia, or 116 of crystallized Salt, according to our definite proportions.*

A gallon of these waters generally yields a quantity of crystals of Sulphate of Magnesia, equal to 170 grains of the salt desiccated, with as much Sulphate of Soda, besides earthy precipitates. The perfect crystals assume the shape of four-sided prisms, surmounted by quadrangular pyramids; shorter than those of the former sulphate, and commonly about half an inch in length, and a quarter of an inch in breadth, where they adhere to the sticks at the surface of the cooler; but of a smaller size, long and slender like needles, towards the bottom of the vessel. Although an opinion has prevailed that they are Sub-sulphates, they are certainly perfect Neutrals, the definite proportions consisting of 33 parts Sulphuric Acid—16 Magnesia—and 51 Water. Thus Magnesia, (an almost insoluble body) is so completely changed by the chemical union, that it forms a Salt, soluble in its own weight of water at a temperature of 60° and in three-quarters of its weight of boiling fluid. This distinguishes it from the Sulphate

* Dr. Wollaston's Method.

of Soda, which is not quite so soluble in the hot, and greatly less in the cold water; but the difference is so little, as to require great exactness, in crystallization, and repetitions of the operations to obtain these salts separate. By being insoluble in spirits of wine, an equal bulk of it added to these waters, produces an immediate deposit of crystallized Magnesian Sulphate. They deliquesce, by exposure to a very gentle heat, but are not so efflorescent in the air as the former crystals.

The *Medical Virtues* of these waters are so similar to those of the former Sulphate, that we cannot form so distinct a judgment of their respective operations upon the body, as might be expected from the difference of their chemical characters. They do not possess the properties of common Magnesia, as some persons might suppose from the name of the waters; but on the contrary, they are extremely bitter to the taste, and pass quickly through the body as a mild cooling laxative. So very much does a large bulk of water increase the power of saline purgatives, that a pint and a half of water, which contains so little as one hundred grains of this salt in a gallon, will operate as a laxative with many persons. They also excite the action of the exhalent vessels, but in a lesser degree according to the briskness of their cathartic operation.

3. The *Muriatic Waters*, in which Muriate of Soda prevails, are few at Cheltenham. The most remarkable of this kind is the Chalybeated and Sulphurated Saline Water in the engine-house, which abounds with sea salt. Small portions of common salt are found in all the mineral waters of the place, and serve to meliorate the flavor of the other salts; but in some it forms the chief saline impregnation, readily known by their brackish, or simply salt *Taste*, which leaves no impression of bitter on the palate, like the other aperient waters.

A solution of Nitrate of Silver is one of their best chemical *Tests*, as the silver immediately precipitates with the muriatic acid of the salt, in the form of a dense white powder, which changes to blue by exposure to the light of day. To ascertain that the precipitate proceeds only from sea salt, a few drops of Nitrous Acid, and some Nitrate of Barytes, should be previously added, and the water filtered. Nitrate of silver slowly added to the waters, as long as a precipitate appears, 235 grains of the dry Muriate of Silver will indicate a hundred grains of common salt.*

These waters are never evaporated for their *Crystals*, they are so abundantly obtained at

* Kirwan's Analysis of Waters, p. 239.

little expence by other operations. But for the purpose of chemical experiment, we generally get more than 500 grains of disiccated Muriate of Soda from a gallon, accompanied with a large proportion of selenite. The crystals are formed at Cheltenham in perfect cubes, commonly as large as a pea ; and their constituent principles are 46 parts of Muriatic Acid—and 54 of Soda. But those which subside in preparing the sulphates from an union of all the waters of the place, contain also a considerable portion of Iron, intimately mixed in the crystals.

Like common salt obtained from other sources, they are extremely soluble in water of any temperature, requiring only $2\frac{13}{17}$ their weight of water at 60°, and nearly the same proportion of the boiling fluid, to dissolve them. Their strong solutions are therefore, not liable to deposit the salt on cooling, like those of the sulphates ; and they crystallize in chemical operations, by slow evaporation in the heat, while the other salts crystallize in the cold. The crystals do not effloresce on exposure to the atmosphere, but are liable to attract moisture from it, in consequence of their being commonly adulterated with Muriate of Magnesia. They volatilize in strong heat, and burst with a crackling noise in the fire.

The *Medical Virtues* of Muriatic Waters, are by no means to be compared with the more cooling and purgative ones of the sulphates.—They require to be taken in larger quantities to operate on the bowels, and by usually containing a greater proportion of saline matter in the gallon, they are apt to produce thirst and heat, and to stimulate the general system more than the other aqueous aperients. They are however well calculated to destroy worms in children, and are generally applied in scrofulous and glandular diseases; at the same time, the other medicating ingredients, usually associated with a large proportion of sea salt in these waters, render them valuable remedies in a variety of other chronic diseases, that do not require consideration in a general prospectus.

III. CARBONATED IRON.

It is found in most of the waters of Cheltenham containing Sulphates and Muricates, and proves of as much importance in stamping their character, as the predominant Salts. Some contain as much as 5 or 6 grains of Iron in a gallon of water, without communicating the inky or rough astringent *Taste* of a chalybeate to them, except with persons in the constant habit of tasting mineral waters; in consequence of the greater abundance and pungent taste of

the neutral salts, they also contain; the water No. 1, at Montpelier pump room, and that of the original spa are of this kind.

The gallic *Test* strikes a purple color with most of these waters, without their concentration, and there are few mineral waters in or near the town, which are not changed to a dark green colour, by standing a day or two with this re-agent. The prussiate of potash, aided by nitrous acid, seldom fails to impart a greenish blue color to those which contain the minutest portion of iron.

The constituent parts of the chalybeate impregnation are Oxyd of Iron, held in solution by carbonic Acid Gas; which latter is a fugitive principle, liable to quit the waters in the open air, and subjects them to great variation of properties. It is also driven off by evaporation, and a Carbonate of Iron is accordingly found in all the precipitates. Nothing can indicate its abundance more obviously, than the orange colour the condensed fluid receives, during the process of crystallization, and the reddish tinge acquired by the salts, which renders their subsequent purification necessary. But we judge more precisely of the quantity each water contains, by precipitating the whole metallic base, by known proportions of prussiate of potash and chalybeate water, after the earth

and salts have been separated from it, and then calcining the insoluble precipitate of Iron.

The *Medical Virtues* of the ferruginous principle, joined to those of the Neutral Salts, give the saline chalybeate a general preference to all other kinds of aperient waters. To remove diseased fluids from the body, and at the same time enable it to prepare healthy ones, are primary objects of medical practice in chronic diseases. Hence the cooling, laxative, and diluting properties of these waters, aided by their tonic action on the stomach, sufficiently explain the rapid restoration of appetite, and the many recoveries from states of indigestion, and weakness, experienced by the invalids of Cheltenham.

IV. SULPHURETED HYDROGEN GAS.

This, the Hepatic Air of old authors, is an important ingredient in some of the Cheltenham Waters, as well Sulphates as Muricates. The water No. 2, in Montpelier pump room and of the Orchard Well, are of this kind. But it used to be exhaled from some other of the waters for many years after their discovery, which now forms no part of their character. They derive no sensible *Taste* from the sulphurous impregnation, because the sweetness that the Gas naturally imparts to a pure liquid,

is completely overpowered by the abundance of saline matter, contained in all the Cheltenham waters.

But their peculiarly nauseous and fetid odour, frequently compared to the smell of a foul gun barrel or rotten eggs, are never-failing evidences of the presence of the smallest portion of this elastic fluid. It gradually escapes from the waters in open situations, or by encrease of temperature, in consequence of its elasticity; which is the reason that the waters always continue transparent, and suffer no decomposition from the action of the atmosphere, and also that they become more fetid by close confinement. They possess a considerable degree of briskness, as they generally contain a bulk of 7 or 8 cubic inches of Carbonic Acid Gas, together with, from 10 to 16 cubic inches of Sulphureted Hydrogen, in the gallon of water.

The Hépatic Gas may likewise be detected by chemical *Tests*, from its property of tarnishing metals. Invisible words written with a solution of silver or lead, generally turn blackish by immersion in the waters fresh from the pump, and often by being merely suspended over them in the well. Three and a third cubic inches of this Gas indicate the presence of a grain of Sulphur; but neither a genuine sulphur, nor its compounds in the concrete state,

have ever been detected by the author in the glasses ; and when a cubic inch of strong Nitrous Acid, (one of the best tests for decomposing this gas, or other compounds of sulphur) was added to an equal portion of these waters, neither turbidness nor scum on their surface took place, after standing a fortnight. Nor did it occasion an evolution of fetid smell, or deposit of sulphur, with any of the Hepatic Waters.

The *Constituents* of common Sulphureted Hydrogen Gas are, 71 parts of Sulphur, dissolved by 29 of Hydrogen, and rendered gaseous by caloric.* These are derived from the decomposition of pyrites and water, forming Sulphuric Acid and Sulphureted Hydrogen, which latter is absorbed by the particles of saline water percolating the earth. Hence the reason that we often find an encrease of their fetor after continued rain, by its passing over fresh portions of pyrites in penetrating the soil. A hundred cubic inches of water at a temperature of 55° is capable of absorbing 86 of Sulphureted Hydrogen ; † and hot water takes up more than cold, which is the reason that some thermal waters on the continent, abound with it. The waters of Cheltenham likewise emit it more

* Thenard. Ann. de Chim. xxxii.

† Henry Phil. Trans. 1803, p. 274.

abundantly in summer than in the winter season. As Hepatic air is capable of uniting with a dose of Sulphur beyond the point of saturation, it may also exist in waters, in that state.*

Sulphureted Hydrogen likewise exists in combination with alkaline or earthy bases, as well as in the gaseous state, forming a transparent colorless solution with water. As it more readily unites with lime than with the other earths, we frequently find a Hydro-Sulphuret of Lime forming a clear bitter solution with cold water, but extremely liable to decomposition on exposure to the atmosphere. Hence chemists are enabled to explain the many spontaneous deposits of Sulphur in the bottom of vessels, and the different colored incrustations found in the channels of sulphur waters upon the continent of Europe. But the several forms in which sulphur appears are not well understood, and the opportunity of examining the bottom of the wells of this place, so seldom occurs, that the author can offer nothing new upon the subject, from his own observation.

It is however necessary to mention, that Mr. Accum obtained by a series of chemical experiments, from a gallon of one of the strongest sulphureted waters of Cheltenham, 32 grains

* Kirwan's Analysis of Waters, p. 11—62.

of a pulverulent precipitate of grey Hydro-sulphuret of Lime; and also procured 11 cubic inches of Sulphureted Hydrogen Gas, from a like quantity of the same water.*

Some chemists have entertained the opinion, that Iron is incompatible with Sulphureted Gas in waters, because the latter is generally employed as a test of metallic solutions, by abstracting their oxygen; but the fact is indubitable, that minute portions of carbonated Iron continue in a state of transparent union, in the strongest sulphureted waters of Cheltenham; and Kirwan has adduced several other instances, of minute portions of antagonist salts co-existing in large quantities of cold fluid.†

The *Medical Virtues* of sulphureted Hydrogen Gas are more apparent, from its sensible effects in curing diseases, than from any knowledge we possess of its modes of acting upon the body. It does not seem to exert any remarkable powers on the stomach or bowels, by producing sickness or alvine evacuations, without the aid of the neutral salts of the waters; but it certainly encreases the energy of the ex-

* Experiments on Cheltenham Waters by F. Accum, 1808, p. 57. The above experiments were made on a sulphureted water in the Octagon Turret, which is now shut up and used only for making Salts.

† Analysis of Waters, p. 137.

halent vessels of the skin, lungs, and kidneys. Sulphur taken in the volatile state, must pervade the system of vessels much quicker, and act more powerfully upon the nerves by its odour, than the almost insoluble concrete, which cures a certain cutaneous disorder, by transpiring through the pores of the skin.

A course of sulphureted saline waters has no effect of tarnishing metals in the pocket, like the stronger preparations of sulphur. The Hepatic Gas is in fact, only an accessory ingredient of the waters, and their curing diseases of the surface of the body, depend as much upon their neutral salts, and the diluting principle of the water, as it does upon their gaseous contents. They are also found, from this union of principles, to restore health to depraved habits of body, and to remove glandular and biliary obstructions.

The TEMPERATURE of waters, noted in most analyses, might also be adduced as a general principle affording a distinctive character of the operations of the aperient ones, upon the human body. From the great depth of their wells, they have a steady and nearly uniform temperature, which differs little in the several species. We find none under 50°, or exceeding 54°, with the atmosphere at 60° of Fahr; a dif-

ference so trifling as to preclude the necessity of particularizing the temperature of each water. Besides, sensations of heat and cold, both internally and externally applied to the body, are entirely relative to the state of the living fibre. If we put into two basons, water at a temperature of 60° , and immerse the left hand in a cool state, into one, and the right hand after being chaffed or heated at the fire, into the other, the water will feel much colder to the right than the left hand.

Whether they taste cold or hot, they do not communicate their own temperature to the body, as they soon acquire that of the stomach; but they both prove stimulant, and produce effects which may influence the actions of the general system. A draught of very cold water may either restrain a hemorrhage, or produce a shivering fit; or it may induce profuse perspiration in a different state of the vessels. At their usual temperature from the pump in summer, they taste gratefully refreshing and cool; but in many cases when the system is highly excited by augmented heat, or diseased sensibility, it is necessary to take off the chill, by adding a spoonful or two of boiling water to each glass. When much heated, they are liable to produce nausea, relaxation, or vomiting, and are rarely taken in this state, except in cases of obstructed glands and bile ducts.

Having premised a general history of the chief saline impregnations of the aperient waters, together with their operations on the human body; and pointed out an easy method for persons little skilled in chemistry to satisfy themselves of its truth, it remains to apply the observations to those waters which general experience has brought into use at Cheltenham; and for this purpose, the author evaporated five gallons of each of the waters, during the months of January and February last. At first, by a heat of 130° to the point of full saturation, and then in a heat from 90 to 50° , during the time of crystallizing. The crystals were afterwards freed from their water of crystallization and weighed. A single gallon of each was also evaporated to complete dryness, to ascertain the whole amount of solid contents.

Finally, the sapid salts severally re-dissolved in a large bulk of fluid, and compared with the native waters, afforded satisfactory proofs, synthetically, of their resemblance in taste, chemical action, and medical operations;

It must appear evident from the preceding observations, that a considerable diversity exists among Cheltenham waters, by reason of the differently impregnated states of the soil. We never see two analyses of waters in different situations, nor even in the same situation exactly alike, and this is founded on the agreeable and useful variety, so often found in nature. But other circumstances less fortunate likewise appertain to these waters; a changeableness now and then takes place in some of their principles, and in the amount of their solid contents, as will become apparent by the following description of each.

THE OLD OR ORIGINAL SPA.

It has acquired the name from being the first mineral well discovered at Cheltenham, as related in the preface to this book.* It is situated in the middle of an avenue of beautiful elm trees, not five hundred yards from the church, or centre of the town.

The water enters the well by small apertures at the side next the orchard; and it never collected more than 58 gallons in 24 hours. This scanty supply gradually diminishing, it was en-

* Mrs. FORTY having pumped at it 41 years, it usually goes by her name; but this, as well as the Orchard Well adjoining, are the property of the Rev. Nash Skillicorn.

larged in the year 1808, to 19 feet deep, and six wide. Since that time, the supply of water has been increased, and its transparency improved. And it has lately had an addition, from an adjoining well covered by a small brick building. The author having an opportunity of examining the spring of the old well, when the alteration was made, observed, that the water trickled drop by drop into it, at the side next the orchard. He has since discovered, that all the other wells of aperient waters receive their supplies in a similar manner, by an oozing of fluid through pores in the blue clay, and frequently at particular places only.

This water cannot be considered as nauseous, it tastes but slightly saline, with rather more of the bitter than the other alkaline waters. It now emits no effluvia of sulphureted Hydrogen Gas at any time, as it used to do for half a century after its discovery, especially in the time of heavy rains. The temperature at eight o'clock in the morning is usually about 54° , and at noon in the middle of summer, five or six degrees higher.

It yielded a few weeks ago 330 grains of solid contents, from a gallon of water evaporated to dryness,* but this is not a steady result, the

* Dr. Fothergill states the saline contents of a gallon to consist of 480 grs. Sulphate of Soda and Magnesia—5 Mu.

author found it in some evaporations to amount to less, and at other times to 100 grains more. It consisted of two-thirds Sulphate of Soda, a small portion Sulphate of Magnesia, and a few grains Carbonate of Iron, in the gallon. Hence the reason why the liquid during crystallization was of an orange color, and iron-moulded linen. The author observed a few years ago, that it turned purple with the gallic test in the morning, and did not exhibit the same appearances in the middle of the day, especially after pumping, when the consumption was great, or when the water had been long exposed to the air; circumstances which denote the propriety of drinking these waters early in the morning, and at the fountain head.

It is employed for all kinds of diseases requiring a cooling, laxative remedy, as it operates with great expedition in the alimentary canal, without producing gripes; it also acts as a tonic, and is much esteemed in all hypochondriacal, and bilious states of the system. It appears, from a comparison with the statement of

riate of Soda—40 Sulphate of Lime—25 Carbonate and Muriate of Magnesia—together with 5 grs. of Oxyd of Iron. But the states of desiccation of the salts are not mentioned. He likewise got 30. 36 cubic inches of Carbonic Acid, besides 15. 18. of Azotic or Hepatic Gases from the gallon.—*Exp. Enquiry concerning Cheltenham Water*, by R. Fothergill, 2d Ed. 1788.

old authors, that this water retains the same laxative properties it did 60 years ago, since a less quantity than two pints, proves a sufficient dose for most persons.

The author established *Sherborne Well*, in the year 1804, at the summit of Badgeworth lane, about a hundred yards above the present Montpelier Wells, when there was only one mineral well, (the original spa,) at Cheltenham, to supply an increasing number of drinkers from all parts of the world. It supplied such an abundance of an excellent alkaline water, that nearly a hundred gallons were drunk daily, during the space of two years. The popularity of this discovery, gave rise to the formation of Montpelier Wells, and all the other aperient ones now in use; but they drained it so entirely of its water, that the building has been lately removed to the upper end of Montpelier pump room, for the sale of toys and curiosities. The fact however, furnishes a strong proof that these wells may interfere with each other, at short distances, notwithstanding the peculiar nature of their springs.

THE ORCHARD WELL.

The name is derived from its situation at the top of a field of fruit trees. The well, about 24

feet deep, is covered by a large brick building, with nearly a square pump room. It was opened in the year 1807, as an auxiliary to the original spa; from which it is not 200 yards distant. The water generally stands in the well at the height of ten feet, but it was drunk so low in the summer of 1863, before the establishment of Montpelier wells, as frequently to render it turbid. The water however is now abundant, and perfectly transparent. The temperature is 52° when that of the atmosphere is 60° , which is 2 degrees colder than the water of the original spa, from the greater depth of the well.

The taste is slightly alkaline, accompanied in summer with an odour of sulphureted Hydrogen Gas. It effervesces on adding strong nitrous acid, in equal proportions with some of the water, but deposits no sulphur. This water emits Hepatic Gas more abundantly at one time than another, since it had a strong smell of it for several years after its discovery, and nearly lost it in two subsequent ones. It possessed it to a great degree last summer, and is devoid of it this spring; but it is expected to recover it again in the hot season. It never was so weak as at present, (April, 1814,) it yielded only 230 grains of solid contents evaporated to dryness, which consisted chiefly of Sulphate of Soda.

From the cooling and laxative properties of the neutral Salts, it is employed chiefly for the cure of stomach and biliary diseases.

MONTPELIER WELLS.

They receive the name from their situation at the upper corner of a healthy field, commanding a beautiful prospect of the town, and surrounding country; which is also supplied with convenient rides, and gravel walks. The long pump room is a low building, sheltered with a piazza, and distant about 800 yards from the church and centre of Cheltenham. It was opened in May, 1808, and the waters soon acquired a celebrity, which gave rise to the following arrangements,*

Four species of aperient waters appertain to this concern, and three of them are served from a common pump-case in the middle of Montpellier pump-room, by different cocks, that have names and numbers affixed to them.

THE CHALYBEATED SALINE, discharged from No. 1. derives the name from con-

* The proprietor, Henry Thompson, Esq. has formed large establishments for conveniently drinking the waters, and for the preparation of Salts from them.

F. Accum published in 1808, the Analyses of five of the Cheltenham Waters, belonging to Mr. H. Thompson, but none of them are now in use for drinking, which precludes the necessity of adducing his statements.

taining Iron, without the impregnations which mark the other waters, although they also contain Iron. The well, 44 feet deep, is covered by a small semi-circular building, with a piazza in front; and situated about 12 yards above the pump-room. The supply of this water amounts to 800 gallons in 24 hours; it is always of a transparent color; and retains a temperature of 53° when the pump room is 60° from the great depth of the well. It sparkles when poured from one glass to another.

A water of the same kind is also discharged from a cock, No. 4, in the circular counter, which the pumper has been in the habit of calling *all saline*. It comes from Bescroft well, 42 feet deep, on the opposite side of Badgeworth lane, and covered by a tall thatched building.

They have a simply salt taste, with less of the chalybeate flavor than might be expected from their Iron, and they never emit sulphureted Hydrogen Gas. No precipitate of Magnesia takes place from pure Ammonia, as they contain almost wholly Sulphate of Soda, with some Muriate of Soda, and three or four grains of Iron in the gallon. The solid contents of No. 1, were 360 grains, and of No. 4, 380 grains, in the gallon.

It acts as a tonic to the stomach and general system, at the time that it evacuates the

bowels, and promotes a flow of urine ; it has therefore acquired great reputation for the cure of dyspeptic, and biliary diseases.

The **SULPHURETED SALINE**, pumped from No. 2, and 3, are drawn from the same well, 46 feet deep, directly under the pump case ; and it collects 2000 gallons in 24 hours. There is a shade of difference between them. The water, from the inner cock, No. 2, is stronger of sulphur and salts than No. 3, because the suction-pipe dips within three inches of the bottom of the well, whereas, the pipe of the latter penetrates no deeper than within 3 feet 6 inches of the bottom, and the specific gravity of the water is greater at the bottom than the top of the well.

It has a salt taste, with a fetid, nauseous odour, from containing a large portion of Hydrogen Gas. It is perfectly transparent, and suffers no decomposition from standing ; but it loses its gas from a short exposure to the air, and should therefore be drank as soon as the glasses are filled. It is therefore evident that Cheltenham waters containing Sulphur, or Iron, can never be drank to much advantage at a distance from the wells. It yielded 350 grs. of solid residue, nearly all Sulphate of Soda, with a little Iron, and deposited no precipitate with pure Ammonia.

The sulphureted waters are as purgative as any of the others, and are employed for the cure of cuticular and rheumatic diseases, as well as for biliary ones ; and there is no other difference in the medical properties of the two numbers, excepting that No. 2 is a little stronger than No. 3.

The **MAGNESIAN WATER** has lately been found in a distant field called Bald-hill, near Bays-hill Lodge, where there are three wells of the same kind, and the principal one, 22 feet deep, is covered by a shade of elm boards, and a crab apple-tree ; but its supply of water amounting only to 24 galls. a day, the waters of the others are also conveyed to the pump room, and served out from the cock No. 5, in the circular counter.

The water tastes bitter, and slightly saline, but has no particular smell. It is perfectly transparent, and emits air bubbles on shaking.

The temperature is about 54°, when the atmosphere is 60°, but it rises some degrees higher in the months of June and July. It produces an immediate precipitate with pure ammonia. The gallon of water yielded 420 grs. of dry residue, and it consisted of half Sulphate of Magnesia, with nearly as much Sulphate of Soda, and two or three grs. of carbonated Iron.

It operates on the bowels and general system,

nearly in the same manner as the Alkaline Waters, and like them is employed in Dyspeptic, and Biliary diseases. It also proves useful in Gravelly complaints.

CHALYBEATED & SULPHURETED strong SALINE, constitutes a fourth species of aperient water. The well, 40 feet deep, is situated immediately under the pump in the engine-house, where the salts are made. It does not yield more than 25 gallons of water a day, and is delivered by the outer cock.

It has a nauseous pungent taste of Salts, Iron, and sulphureted Gas, and is by much the strongest water at Cheltenham; not unlike the sulphur water of Harrowgate in many of its properties. A gallon yielded 650 grs. of dry residue, which consisted almost wholly of Muriate of Soda, with about 8 grains of carbonated Iron; and therefore is never used for the crystallization of salts.

From being lately discovered, its medical virtues have not been well ascertained, but it is certainly a strong stimulant; and there is every reason to suppose it will prove an useful tonic, to the stomach and general system, in a great number of disorders. It is calculated to be particularly serviceable in glandular diseases. But the dose must be confined to half a pint

on first using it, and the chill taken off in cold weather, lest it should occasion spasms about the stomach; double that quantity may afterwards be taken, which will in most cases render it sufficiently aperient.

ALSTONE SPA.

It adjoins the house named Alstone Villa, situated about 20 yards from the north bank of the Chelt, and a quarter of a mile from the lower part of the town of Cheltenham. The Well, 40 feet deep, is covered with an octagon Pump-room, and accompanied with a pleasure ground for the promenade of the drinkers.* It was opened for public use in 1809, and the water was analysed in London the following year, when it was uncommonly strong and briny; but it has undergone a great change of properties since that time.† At present it tastes saltish, leaving a very slight impression of bitter on the tongue. The supply is inexhaustible;

* The Proprietor is the Widow of the late Mr. E. Smith.

† M. F. Accum in the year 1810, by an Analysis made in London, got 466 grs. of Muriate of Soda, besides 182 grs. of Sulphate of Soda, and 18 grs. of Carbonated Iron, independent of Minor Salts, from a gallon of this Water; also 6 cubic inches of Carbonic Acid Gas, and 10 of Atmospheric Air, from a gallon.

and it sparkles in the glasses, from containing a large proportion of Carbonic Acid Gas, without any sulphureted Hydrogen. A gallon of water evaporated this season to dryness, yielded 278 grs. of solid residue, chiefly Sulphate of Soda, with about a fourth part Muriate of Soda, and 5 grs. of carbonated Iron.

It operates as a gentle laxative in doses of three half pints, and is well calculated to remove Biliary diseases, and to act as a tonic in cases of Dyspepsia, and constitutional debility.

As it may serve to confirm the foregoing opinions of the chemical contents of the several waters, and throw some light upon the existing controversy concerning the nature of the Salts, obtained at the laboratory near the Chelt, Mr. Thompson has enabled the author to state, the processes employed in preparing them, upon a large scale of operations.

PREPARATION of APERIENT SALTS.

Some years ago, *Crystals of Sulphate of Soda* were prepared, by conveying the four first waters of Montpelier pump room, in under-ground pipes to the laboratory. The boilers were fed with them night and day for a week, and the

fluid concentrated, from about forty parts to one, was drawn off, and cleared from its earthy precipitates by decantation. The depurated liquor then evaporated in shallow vessels over steam heat, produced large crystals of alkaline salts, with the most perfect figure of Glauber salt; but they were united with some carbonate of iron, as appeared by the gallic and prussic tests; and likewise contained a little Carbonate of Soda, which caused them to taste alkaline, turn the test papers brown, and precipitate magnesia from its solutions. Sir H. Davy, who analysed them,* says in a letter to Mr. H. Thompson, dated March 1811, “these crystals contained a peculiar combination or intimate mixture of Glauber salt and common salt, with a Carbonate of Soda and Iron. The Iron is united in the salts, and can also be united artificially.”

Crystals of Sulphate of Magnesia have been lately obtained in the same chemical operation with the alkaline salts. The boilers, which can consume almost 2000 gallons of water in 24 hours, are supplied with nearly equal proportions of Magnesian waters, (of the same kind

* 1000 grs: of Cheltenham Salts contain 590 water—386 Sulphate of Soda—44 Muriate of Soda—3, 5 Carbonate of Iron—about 2 Carbonate of Soda—and 5 loss. The statement of Sir H. Davy.

with that numbered 5 in Montpelier Pump-room,) and of the alkaline waters employed in the former process. These evaporated to a pelicle, in the first place, yield crystals of Sulphate of Soda in the manner before described. The evaporation carried on with the residuary bitter and ferruginous liquor, the muriatic salts are deposited, and crystals of Sulphate of Magnesia are next obtained. These, by repeated crystallizations, are freed from Iron, or nearly so; and the whole operations are completed in three or four weeks; but the crystals are afterwards dried, by a more tedious operation, into the convenient form of a powder for immediate use.

It is worthy of remark, that in the latter process with the union of different species of waters, the author could not detect the smallest portion of Carbonate of Soda, combined with the Sulphate of Soda now prepared, as was discovered by Sir H. Davy, in the salts obtained by the old process. But Mr. Thompson, says "he gets nearly a third more of the Sulphate of Soda from a gallon, than he did with the Alkaline Water singly. He now obtains more than an ounce from a gallon, which did not before yield much above three-quarters of an ounce; and his explanation is, that both his Alkaline and Mag-

nesian Sulphates, contain an excess of base ; and that the super-abundant Soda found in the alkaline Salts of the first process, unites with part of the sulphuric acid of the Magnesian Salt, and encreases the proportions of Sulphate of Soda in the second process."

The *Earths precipitated* by ebullition, consist of eight parts of carbonated Magnesia, and two of carbonated Lime ; from which the magnesia is separated for use. These are blended with so much iron, as to undergo a spontaneous change, from a white paste to a brown powder, by exposure to the atmosphere ; and the crystallized Salts obtained in the former processes, are also so loaded with Iron, that they require to be three or four times re-dissolved, to purify them ; the author thinks it is in some degree derived from the iron boilers, and crystallizing vessels, as he could not obtain any thing like the same proportion, from evaporating the water in glass vessels. A carbonate and sulphate of Lime are likewise found, incrusting the bottom of the iron boiler with dark layers, which require removal every fortnight, to prevent the destruction of the vessel.

The *Mother liquor*, the relics of all the operations, contains an abundance of crystals of Muriate of Soda, and some Muriate of Lime,

blended with iron. Hence, the crystals of Muriate of Soda, raked from the bottom of the coolers, are of a red color, from the quantity of iron they contain. But neither these, nor any other part of the residue, have been brought into use for the arts, chemistry, or medicine.

CHAP. V.

THE ADMINISTRATION OF APERIENT WATERS IN DISEASES.

THE subject of the purging plan, which embraces a number of miscellaneous diseases, is one of the most important branches of the practice of physic; and next to those of the biliary kinds (to be separately considered,) stomach, cuticular, and gravelly disorders, receive the greatest benefit from aperient waters.

The following pages will, in most cases, suffice to direct patients to the proper use of these waters; but it is impossible to particularize every disease to which they are applicable, or to give printed directions sufficient to guide the patient in the use of the waters, at all times; since the human body, both in its natural and diseased state, undergoes such constant changes, as to render a remedy that proves benefi-

cial at one time, prejudicial at another. Besides, some diseases that receive benefit from the waters, are often complicated with others which do not require them; and those that require them the most, take place in debilitated constitutions, which render their administration doubtful, or perhaps dangerous, and therefore require the advice of the physician.

But they may be taken in moderate doses, without risk, in the greatest number of diseases; and their use can be continued a greater length of time than any other kind of purgative remedy; from the proportion of nutriment being increased, and the system supported under evacuations, by the water improving the appetite. The author has seen a dose of aperient water taken every morning, for eight weeks together, where the cathartic operations did not exceed three times a day, attended with the utmost advantage to the health; nay, he knows some persons, residing in the place, who take them daily as laxatives, all the year round; he is however of opinion, that they are useful in many diseases only every other day, and that in most instances, a short intermission of their use after six or eight weeks, becomes necessary to counteract the power of habit on the human frame.

We may state in a general way, that the diseases to which they may be rendered most subservient, are the following; for reasons which shall now be explained.

Depraved Digestion :	{ <i>Loss of Appetite, Costiveness, Flatulency, hypochondriasm.</i>
Diseases of the Surface :	{ <i>Pimples, Spots, Exudations, and Ulcers.</i>
Inflammatory Diseases :	{ <i>Ophthalmia, Rheumatism, and Gout.</i>
Femalé Diseases :	{ <i>Amenorrhœa and Leucorrhœa.</i>
Nephritic Diseases :	{ <i>Inflammation of the Kidneys, Gravel, and Stone.</i>
Organic Diseases :	{ <i>Piles, Fistula, and Schirrous Intestines.</i>
Intestinal Worms :	{ <i>Tenes, Tænia, and Ascarides.</i>
Biliary Diseases :	{ <i>Affections of the Liver, its Ducts, and Secretion.</i>

DYSPEPSIA, or depraved digestion, (the most universal of all diseases) is generally the creature of our own formation, and is seldom found in the early periods of life. The burning heat of climate—the free use of tobacco—tea drinking—over distension of the stomach—indolent habits of life—excessive mental exertions—and above all, the abuse of fermented liquors—are the bane of the inhabitants of large

towns; from which Cheltenham receives the majority of its visitors. They destroy the human system, chiefly, by weakening the tone of the stomach, and creating an imperfect state of the digestive fluids; which soon induce a long train of distressing symptoms, such as loss of appetite—indigestion—costiveness—flatulency—bilious states of the stomach—want of sleep—and a train of nervous symptoms, such as languor, anxiety, and hypochondriasm.

Digestion is performed, by the food being detained in the stomach until the gastric fluids convert it to a sweet, and pulpy mass. This is afterwards united to bile, pancreatic juice, and lymph; and then brought into contact with atmospheric air in the lungs, which gives it a florid color, and completes the process of animalization. But the progressive changes it undergoes by this union, take place only in subserviency to the living powers of the organs; as appears from the organic matters of both kingdoms, being converted into the same kind of bland nutritious matter. Therefore, when the power of the *Coats of the stomach* is diminished, digestion is improperly performed, and want of appetite, nausea, and sickness, are liable to succeed.

This occurs from all the general causes of ill health, but more commonly from the repeti-

tion of unnatural stimulants, acting immediately upon the stomach itself. It may also be rendered weak by improper degrees of plenitude, as it is a bag which contracts by its muscularity, and not by collapse of its sides. It becomes, therefore, necessary to attend to the quantity, as well as the quality of the food we take, since over-distension will have the same effect of destroying its tone, as a deficiency of excitement.

In the weak state of the organ, the *Solvent fluids* become imperfect, and frequently deficient, and thereby permit the alimentary substances to assume their natural tendency to fermentation. The vegetable part turns acid, and the symptoms of heartburn—acid eructation—hiccup—pain of the stomach—irregular appetite—and now and then tickling cough—are liable to intervene. Animal substances likewise undergo fermentation, attended with offensive breath—a greasy eructation of fluid, which inflames in the fire—and putrefaction in the bowels. As the disease increases, restlessness—langour—hypocondriasm—and eructation of torrents of wind, (disengaged from the food, even in the almost empty state of the stomach)—more or less take place, from the chemical, overcoming the animal powers.

The atonic state of the stomach occasions a feeble action to be communicated to the *Intestinal canal*, and costiveness ensues. The aliment remaining longer in the bowels than 24 hours, the natural period for one evacuation, an accumulation of indurated matter distends the large intestines, and produces uneasiness—difficult respiration—and sometimes giddiness of the head. The thinner parts being absorbed, a feverish habit—sallow complexion—white or furred tongue—want of sleep—and highly colored urine—take place. And there not being a proper quantity of nutritious chyle prepared, the body wastes—the strength and spirits become depressed—and a general irritability of body and mind, supervene.

Cheltenham Waters are more in use for stomach complaints than any other disorder. For they are well calculated to lessen the effects of acrimonious matters in the first passages, and to remove an oppressive load of undigested food from debilitated organs, without exhausting the system like drastic purgatives. Besides these effects of their diluting and laxative principles, their irony impregnation and cold temperature, act beneficially in restoring the digestive powers.

DISEASES OF THE SURFACE, called Cutaneous, differ essentially from exanthematous ones, which are attended with specific fevers, and thereby destroy the susceptibility of the skin to receive the same diseases again; whereas, cutaneous ones are local, and are liable to relapses after having once appeared. A great many of them are merely affections of the cuticle, existing beyond the extremities of the capillary vessels, and thereby little under the power of internal remedies.

But all others are connected with the state of the constitution, and a few are hereditary. This is observable from their effects on the stomach and lungs; since we not uncommonly find affections of the skin preceded by loss of appetite, —sickness and vomiting—pain of the stomach, —low spirits—oppression at the precordia—and difficult respiration. And these symptoms appear to be the efforts of Nature to expel something noxious; because the constitution is relieved, when they are driven to the skin, by heat and cordials; and becomes oppressed, when they are expelled from the surface, by cold.

When they are rooted in the habit they are difficult to cure, either by external or internal remedies, and will frequently appear and disappear at stated times, especially in the spring and autumn of the year, the time when the

constitution exerts its greatest power to discharge its ailments upon the skin. The same activity of cutaneous vessels is observable in animals, who shed their cuticular coverings upon the advance of summer. This tendency of the human system, has given rise to the popular idea of scurvies, and to the indiscriminate practice of taking physic, and bleeding, in the spring of the year.

Papulary Diseases, which so often arise from sudden colds and heats, as well as from free modes of living, have always been treated with diet drinks, which can have no other beneficial operation than as diluents, and therefore cannot be so useful as Cheltenham waters, which also divert the humors from the skin, by their purgative qualities. Erithematous Inflammations attacking the nose and face, from irritability of capillary vessels; the Gutta Rosa of delicate females; and the spreading exudations of watery humors, dangerous to be repelled; likewise receive benefit from the Sulphureted Aperient waters, without confining the patient to the house. The scrofulous affections of the glands, usually accompanied with dyspeptic symptoms, or general debility; as well as many painful ulcers, discharging serous humors; will also derive benefit from the Chalybeate Aperient waters.

IN INFLAMMATORY DISEASES more of the irritable than active kinds, such as many Ophthalmias, they may be rendered useful aperients and tonics, and used externally at the same time. Rheumatism and Gout may be relieved by them in some of their stages, especially where a general remedy is required for a length of time; but they are not fit for flatulent gouty stomachs. They may be used with much greater freedom in the swellings and inflammations of the joints of Rheumatic patients, as they contain no more iron than is necessary to improve the state of the stomach, without inducing inflammatory diathesis.

IN FEMALE DISEASES, of the Chronic nature, which often arise from sedentary habits, and local plethoras, considerable benefit may be derived from a morning walk to the Aperient springs. Many gentlemen attend the wells regularly, to wash away the effects of the luxuries of the table; but ladies, less liable to stomach complaints, are equally numerous in their attendance, on account of the benefit they experience from the Chalybeated Aperients. They are serviceable in many cases of Amenorrhœa, and always in Leacorrhœa. These cases often require the aid of the simple Carbonated Chalybeates, which may be taken the

same day with the Aperient waters, at a different hour, accompanied with horse exercise.

NEPHRITIC DISEASES. Inflammations of the kidneys, as well as cases of Gravel and Stone, are relieved from repeated small doses of the waters, to act as alteratives, as well as aperients. No other means having yet been discovered to prevent the generation of calculi, or to dissolve them afterwards, than diluting fluids, Dr. Percival recommended a course of distilled water, as the best solvent, which is a strong argument in favor of persevering in the use of the Magnesian water of Cheltenham; as it combines the principle of dilution, with the aperient one, and is well calculated to alter the state of the secreted fluid, and render it less liable to form depositions, as well as to wash away sandy concretions from the kidneys and bladder.

ORGANIC DISEASES. The Piles, affecting persons in adult years from local plethora and sedentary habits, require a continued use of laxative remedies, and none can be more appropriate than the cooling Aperient Chalybeates; particularly, for the copious sanguineous discharges which alternate with gout, or debilitate the constitution by frequent periodical returns. This species does not admit of being restrained, except by the most gradual and gen-

the means. Fistulous ulcers too; and artificial issues, become connected with the constitution after a length of time; and to obviate a translation of plethora, from the sudden suppression of their discharges, a course of Cheltenham Waters, will give the constitution time to relieve itself from the influence of habit. Numerous patients are sent to Cheltenham with schirrous affections of the Intestines, generally about the rectum or valve of the colon, and from the ordinary remedies ceasing to keep the body regularly solutive. In such cases, the waters are, for the most part, used with considerable advantage, when occasionally aided by other purgatives; or the use of Dr. Falconer's forcing syringe; but these at last fail in their purpose, from the incurable nature of the disease.

WORMS, of various kinds, infest the different parts of the human body, like parasites in other animals. A certain proportion of these are consistent with a healthy state of the body; since straggling ones now and then appear, where they were not supposed to exist. But when those of large size become very abundant, they are attended with a variety of symptoms, which resemble different diseases. The *Teres*, or long round worm, greatly resembles the common earth worm; but it is of a different nature;

since it cannot live out of the body. It occupies the upper part of the alimentary canal, and resists the powerful solvents of that cavity, Itching of the nose,—swelling of the upper lip,—sallow countenance,—fetid breath,—sickness of stomach,—grinding the teeth in sleep,—irregular bowels,—tumid belly,—convulsions,—and feverish habit—supervene.

The *Tænia*, or Tape Worm, which likewise occupies the upper part of the intestinal canal, is the most dangerous of all the different species. It is generally several yards in length, and consists of a chain of distinct animals, with a head and tail in common; they destroy the chyle and produce emaciation—voracious appetite—sickness—tumid belly—fainting—intermitting pulse, &c. *Ascarides*, the small white worm, inhabits the lower part of the intestinal canal. By their diminutive size, and distance from the digestive organs, they are sometimes attended with little inconvenience; they produce irritation and heat in the rectum, frequently with tenesmus and mucus dejections.

Worms are apt to attach themselves to the intestines so strongly, that nothing but a continued course of purging remedies will remove the animal and its investing mucus. Notwithstanding, they often require very powerful remedies, a course of Sulphureted water will al-

ways be of service, particularly for children. The Chalybeated and Sulphureted Saline in the Laboratory, will be more efficacious for destroying them than any of the other waters. Many bottles, containing Tape Worms, used to be ranged over the pump at St. Chad's Wells, at Battle-Bridge near London, destroyed by that water, which resembles the Cheltenham water in saline matter, but is weaker in its effects on the body, by containing neither sulphur nor iron.

The Purging waters are CONTRA-INDICATED in cases of debility from old age; infirm old men, of cold constitutions, require something more nutritious. Likewise, in diseases where the nervous system is weakened or the vital power exhausted, purgatives are hazardous remedies.

In both these cases they can only be used to remove occasional costiveness, for if the ingesta and secretions be drawn off from the alimentary canal more rapidly than the constitution can repair the waste, nutrition must be diminished, and symptoms of debility, low spirits, emaciation, and perhaps dropsy or palsy, succeed.

There are few chronic diseases in which the body can bear to be deprived of its due proportion of nutriment; and there are none, wherein the bowels ought to be robbed of their natural mucus (except worm cases), which continued

purges will be apt to do. I consider four or five motions a day, produced by any kind of purging remedy for a fortnight together, to lessen the lymphatic part of the blood, more than the loss of half a pint of blood from the arm, would do in the same space of time. The impropriety, therefore, of a free use of purging saline waters in the following diseases, must be perfectly obvious:

Hæmorrhages,	} Palsies,	} Fevers,
Consumptions,		

Their utility is AMBIGUOUS in affections of the head. To ascertain the effects of Cheltenham water upon an organ so necessary for existence, involves a question of great importance; more especially as prejudices have prevailed against its use, in cases where the habit is pre-disposed to diseases of the head.

Most mineral waters have a tendency soon after drinking, to increase the animal spirits, and produce temporary plethora of the head. Giddi-

* Purges, which are often employed in dropsies are of the drastic kind, to stimulate the absorbents of the general habit, and not of that kind which operates only by drawing off the fluids of the intestinal canal.

ness, headach, and drowsiness, are very common symptoms on the first use of mineral waters, and generally come on immediately after drinking them; but these effects are transient. They for the most part go off again in the course of a few hours, and gradually diminish in force by an habitual use of the water.

Whether these symptoms arise from absorption of the water into the circulation, or from its effects upon the stomach, is not a decided point. They however appear to me to depend upon several causes acting primarily upon the stomach.

The simple fluid principle, water, produces a degree of plenitude and tension in the circulating system. It will also, at times, raise the pulse and produce a copious flow of perspiration, especially in warm weather; from the stimulus of its bulk and temperature, being communicated by sympathy from the stomach to the general system; but partial plethora of the head cannot be ascribed to this cause.

An over-dose of any kind of water not working off freely, may affect the head by distending the stomach. The organ in this state will press upon the large blood vessels and lessen the cavity of the thorax, so as to interrupt the free transmission of blood from the head to the general system, and thus prove dangerous in

cases where there is a tendency to sanguineous apoplexy or mania. Hence it is, that sudden deaths from apoplexy, frequently happen immediately after a full meal, long before the aliment had time to enter the circulation; and heavy indigestible suppers produce night-mare. There is therefore reason to believe, that when the stomach continues over-distended with water for a length of time, it may prove prejudicial to the head.

But the most common cause of cephalic symptoms, arises from the quantity of loose airs contained in mineral waters. The intoxicating effects of carbonic acid gas both in beer and water, (rendered volatile by the heat of the stomach,) are familiar to every person's observation. Malvern and Bristol water, which contain more gaseous than solid matters, produce vertigo, and slight headach; and chalybeates, which contain the greatest proportion of carbonic acid gas, can only be taken in comparatively small doses, on account of their liability, on first drinking, to produce giddiness, headach, and a sense of fullness in the head.*

* Dr. Rutty observes, that the celebrated Pouhon and Geronsterre waters in Germany, which have given origin to the name of spa to many other chalybeates, contain iron, with such abundance of carbonic acid and sulphureous vapours, that they do more harm than good in disorders of the head.

Rutty's Synopsis, Qto. page 31.

But Cheltenham water, which contains a smaller portion of elastic fluids than most other kinds of mineral waters, produces now and then vertigo and slight headach, especially when a large quantity of the water is taken, and does not work off; or when its neutral salts excite nausea. Giddiness is generally a precursor of vomiting, whether it arise from food, medicine, or any other cause disturbing the stomach. But an operation of this nature upon the head, by nauseating the stomach, can never be injurious to the brain or its diseases. On the contrary, Cheltenham water, when it purges, has a tendency to cool the brain, and to lessen plethora in the head. The effects upon the head of the small portion of iron it contains are completely counteracted by its cathartic virtues. It seldom accelerates the pulse, and whenever apoplexy or mania have succeeded its use, they must have arisen from the congestion of the liver, which directed to the use of the water, or from debilitating the constitution, by its too free administration.

MODES OF ADMINISTERING THE APERIENT WATERS.

THE waters are so little variable in their nature, and the modes of using them are so well

ascertained by long established practice, that few observations will suffice on the best methods of applying them to diseases.—The following directions are most deserving of notice, and will apply equally to both the old and new purging wells of Cheltenham.

The best SEASON OF THE YEAR for a course of these waters is the summer, on account of the advantages derived from the co-operation of air and exercise with the water, as explained in the introduction to this treatise. It is also the season which renders the removal of bile, and undigested food from the bowels, most necessary for health.

The waters are likewise strongest, and their refreshing effects most felt, in summer; for most superficial mineral springs are weaker in cloudy and rainy seasons, than in clear dry weather. But they may also be drank in the middle of winter, with considerable advantage, by taking off the chill, or drinking them at the fire-side.

The spring and autumn are likewise proper seasons for their use, on account of the tendency of the constitution to inflammatory and eruptive diseases at these periods. Hence the usual time of the resort of company to Cheltenham, begins in April; the season is at its height, from the be-

ginning of July until the end of September; and the summer company leave it in October, excepting families who intend to reside in it all the winter; of which there have been considerable numbers during these last years.

Travelling in hot weather ought to be gentle and easy, for vascular commotion once excited, may terminate in a feverish habit of body, that will defeat the intended purposes of drinking the water. And for the same reason, it may sometimes be necessary, on the first arrival at Cheltenham, to rest a day or two, before commencing the purging plan.

PREPARATION of the body has been usually recommended, previous to drinking at mineral springs; but with Cheltenham water this is not necessary at all times, because it is often of itself sufficiently active, without any preparation.

There are, however, numerous instances, where the water will distress the stomach or the head, in the ordinary doses, but will agree much better with the patient, by the aid of preparatory medicine.

Invalids in the habit of using calomel, may begin with taking a small portion, in the form of a pill at bed-time, to be worked off next morning with a dose of water at the well. A dose of calomel, for three successive nights, to act

a purgative, with the assistance of Cheltenham water next morning, will be sufficient for most bilious cases, without incurring the risk of its absorption, which ought never to be done without the advice of a medical practitioner on the spot; but as the use of calomel is not eligible for all patients, a preparatory pill of some other kind, may be taken over night, to quicken the action of the water next morning; without incurring the unpleasant symptoms, which sometimes arise from a large portion of the waters, taken at the commencement of a course.

The best TIME OF THE DAY for drinking the water, is found by experience to be early in the morning; and it is seldom used any other time at Cheltenham. Medicines intended to operate in the circulation of the blood, ought to be taken with a full meal; but water, which acts chiefly on the alimentary organs and bile ducts, should be drank on an empty stomach: the use of it at this time is attended with a further advantage of the operation being finished before dinner time. The waters are generally taken at the well, between seven and nine in the morning, and the patient returning soon afterwards to breakfast, the warm tea assists their operation.

The author has known some invalids drink the water at bed-time, for the purpose of remaining all night in the bowels, to work itself

off early next morning, by the assistance of exercise; and in many cases of jaundice, he has directed it to be drank twice a day, to wash the bile out of the vascular system, by acting as a diluent and diuretic. But the general benefit is derived from drinking it only at the pump early in the morning, when the temperature, volatile principles, and iron, enhance the value of the remedy; and the early walk, in the pure cool air, enables those who pursue the salutary practice, to eat a hearty breakfast. The waters generally contain most steel early in the morning, and many of them entirely lose it, in the middle of the day.

The Dose of the water ought always to be moderate on first using, and the quantity increased according to the effects produced on the body. The dose will, therefore, very much depend upon the age, sex, constitution, and disease of the patient; and at the commencement of the course, it will require the opinion of the faculty to determine, whether the water should be drank in such quantities as to gently increase the natural evacuations of the body, or to act as a brisk cathartic.

In the writings of the ancients, and even in modern times, upon the continent of Europe, five or six quarts of mineral waters were consi-

dered as a moderate dose.* But in the improved state of medical science in this country, physicians are adverse to such large quantities.

An over or under dose are equally improper; the one injures the stomach by distention, and the other is attended with loss of time, perhaps during an increasing disease.

These waters are generally intended to produce more or less purging; and it very seldom happens that benefit is obtained from them, by those patients who apply at Cheltenham, without they be taken in sufficient quantity to operate upon the bowels; the dose must, therefore, be regulated by the number of evacuations. They also prove diuretic, which is a property common to all neutral salts largely diluted, and not peculiar to Cheltenham waters alone; although it is not their least effectual operation in the cure of many diseases.

The dose of Cheltenham waters is happily proportioned by nature, to the capacity of the stomach; a pint or three half-pints of fluid drank in the space of half an hour, may be taken in the generality of cases, without producing distention.

* Dr. Rutty, who wrote largely on mineral waters, in 1757, says, in the chapter on the waters of Spa, "Those who drink little are not benefited; the greater quantity any one drinks the better, if the waters pass off well: so that some have drank twenty-one pints in a day." *Synopsis*, p. 333.

by its bulk. A more acrid water, with the medicating properties more concentrated, would render it more nauseous, and less useful in a great number of instances, where its diluting and diuretic properties are required.

A small half-pint tumbler, containing about six ounces of water, and a like quantity repeated, after walking a quarter of an hour or twenty minutes, will, in general, be sufficient to begin with. In two or three days, the quantity may be increased to two glasses, containing twelve ounces each, called well-pints. Some cases may require three of the largest tumblers to be drank, with the use of exercise between each. It is necessary the water should be taken in divided portions, to prevent nausea or distention of the stomach, and accompanied with exercise, to quicken the operation of the water. It is better to drink a quart of fluid of any kind, at three times than at twice, particularly of Cheltenham water, which might produce sense of fulness in the stomach. Three or four tumblers full, drank with a quarter of an hour or ten minutes interval between each glass, will be sufficient in most cases, although many persons imprudently take much larger quantities; yet it is always better to assist the waters with purgative medicines, than to drink four pint tumblers full in one morning.

Large doses of these waters, like those of most other mineral springs, will sometimes swell the ankles; which symptom is often increased by unusual exercise before breakfast in hot weather, to an alarming degree; but in most cases, the author has been able, by certain restrictions, to enable the patient to persevere in the course of waters, without incurring danger, from tumefaction of the feet.

When it disturbs the stomach, instead of passing off freely, Cheltenham salts may be added to one of the glasses. These salts are kept in a state of solution at all the wells, for the purpose of strengthening the water, when not sufficiently active of itself.

The *preparation of concentrated water*, at Mr. Thompson's laboratory, to quicken the operation of the waters served out at his pump-room, consists in evaporating the waters until their earthy salts are separated, and then keeping the fluid in a gentle heat, until all the muriatic salts are thrown down. This depurated liquor, at the point of crystallization when cold, is bottled in wine quarts, each of which contains between four and five ounces of saline matter, in the proportion of two thirds of sulphate of soda, and one third of sulphate of magnesia, without any mixture of earthy or

muriatic salts, which would be liable to disagree with the constitution in a concentrated state. The saline matter contained in a quart, being therefore equal to more than half a pound of crystallized salts, a table spoonful nearly doubles the strength of a pint of aperient waters.

But it often happens that the water cannot be made to operate, even by these auxiliary means, and the utmost skill of the physician is required to render it efficient, in cases of torpid bowels, and in the numerous instances of obstinate constipations from organic diseases, which are sent to Cheltenham, after having foiled the efforts of medical men in various parts of Britain. But, in most of these cases, Cheltenham waters, by particular management, can be made to pass the intestinal canal, and sometimes more readily than purgatives of a more acrid nature.

The symptoms of flatulence, nausea, and vomiting, will often receive some degree of mitigation from pepper-mint drops, æther, or a little tincture of cardamoms, taken with the waters. It is liable to produce drowsiness, which cannot be considered very detrimental; but when it continues to disturb the head with giddiness or pain, the water should be warmed, or exposed to the atmosphere a few minutes before

it is drank, to dissipate the aërial principles, and after drinking it, the patient should walk about in the open air. When it produces gripes, or habitual purging, vegetable food, malt liquors, and acid fruits, should be avoided. These, indeed, should always be used sparingly, at the time Cheltenham water is operating upon the bowels.

THE TEMPERATURE of the water is of more importance than generally imagined. In its cold state, it braces the stomach, and refrigerates the body. In its warm state, it relaxes the habit; and by the loss of its volatile principles, proves less flatulent. But invalids should endeavour to bring themselves gradually to the use of it in the coldest state, unless in cases of gout, rheumatism, spasms, gall-stones, or indurated viscera; and then some of the water, which is kept on purpose by the pumper heated, should be added to each dose.

THE DURATION of the course should be regulated by the nature of the disease, and the effects of the water on the constitution. Those who visit Cheltenham for amusement, are satisfied with drinking as much as relaxes the bowels, for two or three weeks; but invalids in general continue at Cheltenham three or four weeks, except in obstinate chronic cases, which require

complete alteration of the habit; they are then obliged to persevere in a moderate use of the water for months, and sometimes for years, to get their health re-established. It is a very common practice, after these waters have acted powerfully on the bowels for two or three weeks, to take a short excursion to some neighbouring town, or to drink at the steel wells for a week or two, and then return to the use of the aperient waters.

When these waters, by improving digestion, encrease the fat of the body, their continuance is safe for any length of time, but when they produce much emaciation, they should be remitted for some weeks.

The waters should always be left off in a gradual manner, to avoid the mischief that might arise from full diet suddenly succeeding a course of depletion; and for the purpose of a substitute many persons provide themselves with Cheltenham salts, to take two or three times a week in common water, when they leave the place.

CHAP. VI.

SITUATION, ANALYSIS, AND PROPERTIES OF THE SIMPLE CHALYBEATE WATERS.

These are often with great propriety called steel wells, from their similarity of principles to steel, which is also a carburet of iron, and to distinguish them from the aperient saline waters, which are likewise called chalybeates, by containing iron in combination with purgative salts.†

Iron is a metal so universal in nature, that it exists generally in the animal and vegetable kingdoms, and in most colored earths, stones, and sands. It is found in large quantities, uniformly blended with clayey and boggy soils, as

† The word saline is often used in this treatise to distinguish the purging waters only, although, properly speaking, all chalybeates are saline, since iron is insoluble until it is converted into a salt.

well as abounding in the strata and veins of craggy mountains. It is likewise combined with sulphur in detached pieces of pyrites in many clay lands, which we have described to be the case with the saline soil of Cheltenham; at the same time carbonic acid, the solvent of iron, abounding every where in the bowels of the earth, simple chalybeate waters are the most common of all kinds of mineral springs.

But the carbonic acid escaping from these waters, by its elasticity, they lose their iron impregnations, and often become fit for domestic use. All the house-pumps at Tunbridge Wells are chalybeate, but are reduced by boiling to the state of simple water. When pumped on green tea in their cold state, they are changed to a dark or purple color, but poured on it, boiling hot, no such change takes place. In like manner they lose their properties, by exposure to the atmosphere, and by transportation from one place to another, by the escape of this volatile principle.

ORIGINAL CHALYBEATE SPA.

This carbonated steel well, is situated in a level meadow on the bank of the little river Chelt, about two hundred yards from Cheltenham.

ham mill, and the same distance from the top of the town. It is only four feet deep, and the proprietor was obliged to raise a mount of earth, and a plantation of trees, to shelter it from solar heat.*

There existed for many years, an open hole at the side of a running stream, which contained an iron water, that the country people resorted to for disorders of the eyes; and the late Mr. Cruikshanks traced the water by its ochry channels through a thicket of brush wood, a hundred yards nearer its source, and established this well in the year 1803; to which a pump-room was immediately built, within fourteen yards of it.

The water issues from a black gravelly soil, under a yellow clay; and the supply is near a hundred gallons an hour. It is transparent, resembling common water, with the smell and taste of iron; and like other simple chalybeates, produces a brown stain, and a greasy appearance on the tumblers, and becomes turbid by standing exposed to the air.

The temperature of the water from the pump varied from 47° in November, to 60° in August, in consequence of the superficial situation of the well; and the specific gravity in May 1814, was 1,025.

* The proprietor, Mr. Barret, has rendered the access to this delightful spot extremely commodious.

The author's experiments upon the water in May 1814, will serve to illustrate the composition of all the simple chalybeated waters* at

* 1. By exposing the water 24 hours to the atmosphere in an uncorked bottle, it changed nearly to the state of common pump water, with a brownish deposit.

2. When placed over the fire, it emitted air bubbles, and after boiling 12 minutes, deposited a brown powder; which plainly indicated the escape of carbonic acid gas, and the precipitation of iron.

3. Limewater rendered it milky; and sulphuric acid produced air bubbles, with an encrease of transparency, denoting the *carbonic acid* to be considerable.

4. In two or three minutes, one drop of tincture of galls turned a quart of it purple; and 5 drops of prussiate of potash, with 5 of nitrous acid, turned a quart to a bluish color; facts strongly indicating the minute division of matter, by its impregnating so much water. But these appearances did not take place after the water was boiled, in consequence of the loss of *iron*.

5. The solution of nitrate of silver produced a small white flaky precipitate, which became bluish by exposure to the light; and the acetate of lead produced a copious white precipitate, soluble in acetous acid. These indicated the presence of *muratic acid*.

6. The acetate of barytes produced slight turbidness, denoting some *sulphuric acid*.

7. Oxalate of ammonia produced copious white precipitate, indicating the presence of *lime*.

8. Pure potash and pure ammonia, produced a white precipitate of *magnesia*.

Cheltenham, which differ little from each other, except in steadiness of character.

The proportion of these substances was next determined.

9. By evaporating, near the boiling point, one gallon of water to dryness, $64\frac{1}{2}$ grains of solid matter were obtained.

10. This powder digested with 2 ounces of alcohol, was filtered and dried at 212° . The alcohol having taken up muriate of lime, and magnesia, the dried mass weighed only 49 grs.

11. The residue being digested 24 hours with one ounce of cold distilled water, was filtered and dried. The water having taken up the muriate and sulphate of soda, the dried residue weighed 25 grains.

12. After boiling the residue a quarter of an hour in 28 ounces of distilled water, it was filtered and dried. Having lost its selenite, it weighed 16 grains.

13. The undissolved residue was oxydated, by exposure for three weeks to the rays of the sun in a moist state. It did not cease to effervesce, until it was saturated with 2 ounces of distilled vinegar, which took up all the magnesia and lime. This filtered, dried, dissolved in muriatic acid, and precipitated by prussiate of potash, yielded about 7 grains of iron.

14. The spiritous solution which had passed the filter was evaporated to dryness, and moistened with 12 drops of sulphuric acid. This paste exposed to moderate heat, emitted white fumes of muriatic acid; and, urged with strong heat, yielded some lime.

15. The watery solution, which had passed the filter, exhibited, on evaporation, slender crystals on the surface of the hot fluid, adhering to the sides of the bason, which being dried on bibulous paper, proved to be common salt.

16. The boiled solution, evaporated to dryness, by the tests of baryte, pure potash, and ammonia, proved to be sulphate of lime.

This water has a great resemblance to that at Tunbridge Wells, both in its chemical and medical properties; but has not such a steady character as the latter, which rises from great profundity, with considerable force into the stone bason.

CAMBRAY CHALYBEATE SPA.

It was first opened in the year 1807; and the water having acquired a degree of celebrity, a handsome building of ashler stone, with an octagon pump-room and viranda have just been erected, within 30 yards of the well.* It

The *aerial principles* collected over mercury from a pint of water immediately from the spring, were three cubic inches of carbonic gas, which was absorbed by lime water, leaving two inches of atmospheric air in the graduated glass.

Hence a Wine Gallon contains:

	Grains.
Carbonate of iron	7 : 5
Muriates of lime and magnesia ..	15 : 50
Muriate and sulphate of soda ..	24 : 00
Sulphate of lime	9 : 00
Carbonate of magnesia and lime	8 : 95
<hr/>	
Solid contents	64 : 50
Carbonic acid gas	24 cubic inches.

* The proprietor, Mr. B. Jones, has spared no expense in fitting up this well.

is situated near the bottom of the footpath, leading from Cambray to the river Chelt, and close to the coach-road to Mr. Thompson's rides.

The well is dug about twelve feet deep, through a brown clay to a bottom of darkish stone gravel, from which the water ascends to the height of three or four feet. The stone lining of the well is incrustated with brown ochre, and the water has generally a shining blue pellicle on its surface.

The supply of water is extremely abundant; and it has a strong chalybeate taste, and smell; but is not perfectly transparent. The iron is held in solution by a large proportion of carbonic acid, which escapes by exposure to the atmosphere, or increase of temperature, and the iron is thereby deposited. Hence, in twenty-four hours, it is reduced to the state of common pump-water, with a turbidness and brown appearance at the bottom; and the same circumstances occur from boiling it. The bottoms of the glasses are stained brown, and their sides have a greasy appearance.

A single drop of tincture of galls turned a quart of water to a purple color; and all the other tests produced exactly the same appearances with this, as with the former water. In

fact, I cannot at present, discover the smallest difference between them, in chemical or medical properties. This water is rather less transparent; and a gallon evaporated to dryness yielded 58 grains of solid contents.

There is another of these simple chalybeate waters in Mr. Thompson's engine-house, which lately yielded as much as 308 grs. of solid contents from a gallon, and possessed similar properties to these two last.

CHAP. VII.

ADMINISTRATION OF THE SIMPLE CHALYBEATE WATERS IN DISEASES.

IRON is the safest of all the metals in diseases, and not even inferior to mercury as a remedy. All its preparations corrugate the living fibre, as we perceive by their stypticity in the mouth. In consequence of which, they have a tendency to produce costiveness, and are employed to restrain preternatural evacuations, by constringing the extreme vessels of the system.

Iron braces the stomach, and improves digestion, so as to increase the elasticity of the muscular fibre, and excite the nervous energy, by augmenting nutrition. And by increasing the red particles, may be said to generate blood in a double ratio. But Cheltenham waters dif-

fuse the stimulus of iron more generally over the system, than the metal taken in substance. And both the carbonic acid and the cold water, assist in stimulating the various emunctuories of the body. Hence the general glow of heat, increase of urine, and sometimes of perspiration, which often succeed a dose of these chalybeates.

But the carbonated chalybeate waters are more invigorating in proportion to the iron they contain, than is observeable from any artificial and solid preparation of the metal, for the reason, that the acid of the stomach dissolves but a small part of ferruginous powder, and the remaining portion passes downwards without entering the circulation, and thereby gives the alvine evacuations a dark color. Whereas, repeated doses of chalybeate waters do not depend upon the fluids of the stomach for solution, and seldom produce the same effects upon the contents of the alimentary canal.* Hence the oxyd of iron, during its solution in the stomach, is often accompanied with fetid eructations; and by remaining in an undissolved state, is apt to produce nausea, sense of weight, pain of

* Neither Tunbridge nor Cheltenham waters, discolor the intestinal evacuations, according to the author's enquiries on the subject.

the stomach, and sometimes purgings, which seldom arise from a moderate dose of the springs.

Steel waters are INDICATED in chronic diseases, accompanied with debility, and unattended with feverish symptoms, but more particularly in the two following.

In Debility of the Digestive Organs, attended with the usual symptoms of loss of appetite, flatulencies, distention of the bowels, acidity, and vomiting; or in dyspeptic symptoms, accompanied with diseased mind, called hypochondriasis; or in a debilitated state of the stomach and alimentary canal, from hard study, or debauch, the steel waters will prove decidedly useful; especially, if an aperient medicine, such as the waters of the saline well, or an aloetic pill, be interposed once or twice a week, to keep the body solutive during the time of drinking the chalybeate.

In Debility of the Uterine Vessels, producing obstructions, weaknesses, or sterility in females, the steel water proves extremely beneficial. It is sometimes employed in preternatural evacuations of the uterus, to give strength to the extremities of the debilitated vessels. Steel waters are useful in some cases of chlorosis, especially if they be accompanied with stimulating remedies, and horse exercise.

In Convalescent States of the Body, where patients are recovering from fevers, bilious attacks, or other diseases where no visceral obstructions remain, steel waters will restore the tone of the system, and prevent relapses. They are therefore used in cases of decayed constitution, from warm climate or free living. In habitual fluxes, brought from the Tropics, they will strengthen the intestinal fibres, and prove gently restraining.

In Nervous Diseases, from relaxation or delicacy of habit, such as hysterical disorders, palpitations, terrors, imaginary sensations, irregularity and depression of spirit; or those of the paralytic kind, connected with the state of the brain, such as tremors, and palsied limbs, steel water will prove efficacious, in a great number of instances. *In Spasmodic Diseases*, from preternatural irritability of the nervous system, such as convulsions, St. Vitus's dance, and epilepsy, a course of chalybeate water will often prove beneficial.

In Chronic Inflammations of the Eyes, and Eyelids, either scrophulous or otherwise, steel water will be useful, both as an internal tonic, and as a cooling restraining wash, externally applied.

Steel water is CONTRA-INDICATED in a great number of diseases, particularly in some of

those which receive most benefit from the purging waters of the other wells.

In *Inflammatory Diseases*, where the action of the sanguiferous system is increased, as in fevers, hectic states of the body, paroxysms of acute rheumatism, and gout, this water is not a safe remedy. In *Visceral Obstructions*, especially of the liver and spleen, it is a doubtful remedy. It might restore the tone of the stomach, but it would be liable to increase the organic obstruction, by its stimulus and astringency, when taken in a large quantity.

In *Determinations of Blood* to the head or lungs, it should be prohibited; therefore, in vertigo, constitutional headaches, and tendency to apoplexy; or in inflammatory asthmas, coughs, and consumption, it would be dangerous to increase the circulation, or to generate blood by steel water.

In *Dropsies*, it might act as a tonic, and give vigor to the absorbents, but in most cases the quantity of astringent fluid, would promote accumulation of water in the cavities. In *Calculous diseases*, such as gall concretions, gravel, and stone in the bladder, the waters do not contain sufficient carbonic acid and saline matter, to counteract their astringent property.

The Doses of the water of these wells have such variable effects on different constitutions,

as to require time and experience to determine the proportions. Steel waters sometimes produce purging on the first use, or when the bowels are loaded with bile; but this is a rare effect, and ceases in a few days. These kind of waters are never intended to evacuate; their most usual and salutary operation upon the secretory system is, to promote the flow of urine; and, when accompanied with exercise in hot weather, to excite perspiration: which effects arise chiefly from the bulk of fluid and its coldness, and in some measure from the stimulus of their impregnations upon the habit. They may be drank on the intermediate days, or even on the same day, that the aperient waters of the other wells are used, provided the disease requires a bracing remedy.

As they are not strong chalybeates, the general dose of water is well adjusted to the powers of the constitution, and the use safer in doubtful cases than a stronger water, but requires a course of longer duration. Invalids generally drink as copiously as their stomachs and heads will permit, without disturbance. But as a very small quantity will frequently produce giddiness, flushing of the face, and headach, or bring on nausea and distention of the stomach, in some patients, it is proper to begin with one of the smallest glasses, contain-

ing about a quarter or a third of a pint. This may be taken about eight or nine o'clock in the morning, accompanied with half an hour's gentle exercise in the air, and repeated about the middle of the day.

In a few days, if the water has agreed with the patient, three of the same glasses may be taken at equal intervals; for it is better to repeat the number of doses, than to increase the quantity at a time.

It is apt to lose its effect by habit; and therefore in a week or two it may be increased to half a pint. The author has more than once seen a full wine pint taken at a time, without any other effect than eructation of wind; and has himself drank three quarters of a pint of the water three times a day, by way of experiment, without any inconvenience. But he considers two wine pints of it drank at three times, to be sufficient for most constitutions, and for every salutary purpose in any disease. When it is drank at a distance from the well, the bottle must be well stopped, and the cork made to touch the water by screwing it in. The bottle ought not to be heated by the hand, or put into a warm place.

It has been a practice to dilute those chalybeate waters, which affect the head by their loose airs, with common pump-water; and to warm

those, of such a cold temperature as to disagree with weak stomachs, by placing a corked bottle, containing the chalybeate, in a vessel of warm water.* But the water of these wells will not require dilution, nor increase of temperature at any season, otherwise than by warming the glasses at the fire, before the water is pumped into them; and will also be attended with no risk of bursting bottles.

The duration of the course for drinking steel-water generally extends from twenty to sixty days, and longer when the disease proves obstinate.

* Dr. Ratty, page 317, on Pyrmont waters, says, that putting a bottle of water fresh from the well, and close corked, into hot water, until it becomes milk warm, will not deprive it of its iron, and will fit it for stomachs which cannot bear the water cold.

CHAP. VIII.

AN HISTORICAL ARRANGEMENT OF BILIARY

DISEASES IN BRITAIN,

TO DISTINGUISH THOSE REQUIRING PURGING WATERS,

AS half the invalids who visit Cheltenham, are afflicted with bilious disorders, contracted either by long residence in warm climates, or by injurious treatment of their digestive organs, they require particular consideration in this treatise ; but its circumscribed limits, will only admit of a cursory view of their history, for the purpose of discriminating the species which require purging saline waters, in greatest abundance.

Biliary diseases spontaneously divide themselves into two principal classes. Those which depend upon an altered structure of the liver or its appendages, and those which arise from a particular state of the secretion ; independent of the secondary affections of the organs from

pressure of contiguous parts, and the communication of their diseases, occurring nearly as often as the primary ones.

Most bilious diseases proceed from colonial heat; and when generated in cold climates, they arise from a peculiar temperament of body, from getting cold, from intemperance in eating and drinking, and from irregular modes of life. But they are most generally derived from the burning heat of the solar rays, or the liquid fire of the still; which is the reason that men are more frequently affected with these complaints than women.*

SECT. I.

DISEASES OF THE LIVER.

The immense size of the human liver, in proportion to the bulk of the body, manifests its great importance in the economy of life; and the peculiarity of its structure, explains the character of its diseases. No organs are so frequently affected as those of the hepatic system; for not only the large proportion of debilitated blood

* The only exceptions to this proposition are, jaundice and gall stones, to which women are most liable, from their sedentary habits.

received from all the abdominal viscera, but the tardiness of its circulation, render the liver extremely liable to different inflammations, torpor, and congestions. It much resembles the female breast, in many of its congestions, indurations, inflammations, and abscesses.

Its uncommon vascularity and softness of texture, subject it to frequent injuries from external causes. Its size, situation, and contiguity to other vascular organs, occasion frequent adhesions, and inflammations; and render it extremely difficult to distinguish, at all times, between the diseases of the abdominal and thoracic cavities.

So great is the influence of the liver over the whole system, that there is scarcely a part which does not sympathise with its affections, and many complaints referred to other organs, take origin in this gland.* Gout, apoplexy, hypochondria, cholera, melena, hematemesis, dysentery, and piles, are frequently associated with diseased liver; and from the necessity of the biliary secretion for the healthy actions of the intestines and stomach, the hepatic and alimentary organs reciprocally partake of each others diseases. There is also a community of nerves

* Darwin observes, in the first vol. of *Zoonomia*, that the effects of inebriation upon the liver is, to produce gout in the feet.

from the grand sympathetics, and a connection of blood vessels, by the three great branches of the coeliac artery, distributed to the liver, spleen, and stomach. But the connection is more immediate between the liver and spleen, than with the liver and any other organ of the system. The blood obstructed in either of these viscera, renders the other tumid; and their diseases, which are very similar, are communicated from one to the other. This connection is remarkably conspicuous in lingering intermittents, where they frequently become tumid together, called ague cake.* But the spleen, not being an organ so essential to life as the liver, can be increased to twice its natural size, without greatly disturbing the process of digestion, and its diseases are less fatal than those of other internal organs.

The liver, the largest viscus of the body, is more frequently diseased than all the others: It is the well known source of nineteen dropsies out

* The immortal Lord Nelson was under the author's care when he arrived at Jamaica, after taking Fort Omoah on the Spanish main. A severe intermittent fever produced tumefaction of the liver and spleen, which rendered his body as prominent as that of a person in the last stage of dropsy; and he did not recover until he was sent to England, soon after which the ague and tumefaction of the whole belly gradually disappeared.

of twenty. And it may be further subjoined, that the deficiency of muscular fibres, (having no other than those of its blood vessels,) and diminutive proportion of nerves, in its substance, stamp it with a character of great insensibility, which renders its diseases more latent and insidious, than any others that invade the human frame.

INFLAMMATIONS of the liver are of the acute and chronic kinds, known among systematic writers, by the name hepatitis, and in the East Indies where they are endemial, by the common denomination of liver complaint. This disease, although very frequent in the West Indies, is by no means so prevalent as in the East, on account of the regular sea and land breezes, which cool the atmosphere of islands. And, in all probability, hepatitis would be equally universal in Guinea, which is hotter in most places than the East Indies, if it were inhabited by Europeans.*

* The diseases of Europeans in tropical countries are few and uniform. The yellow fever prevails in the West Indies, especially among strangers, on the sea coast, at all times of the year. In the East Indies, hepatitis, and cholera morbus prevail in the dry season, and the remittent fever and flux in the rainy one. The two former occur oftenest among persons who undergo fatigue and exposure to the sun; but the latter are by much the most fatal. The remains of those diseases, fill Cheltenham with bilious patients.

ACUTE OR ACTIVE INFLAMMATION of the liver resembles pleurisy in the intensity of fever, and pain of the side; and in severe colds bringing it on, in the predisposed state of the organ. The pain most commonly extends from the right region of the liver, by the intervention of the phrenic nerve in the diaphragm, to the shoulder of the same side, and is accompanied with quick pulse—heat—thirst—difficult respiration—dry cough—and vomitings. The right hypochondrium is sometimes swelled, and painful to the touch, and the patient lies with greatest ease on the diseased side.—Suffusion of bile is observed in the eyes—and the urine is highly colored—although real jaundice seldom attends the acute state of the disease. Hæmorrhagy frequently occurs from the nose; especially when the patient has not been freely blooded.

As the tumefaction of the liver arises from increased action and dilatation of its vessels, it is most frequently carried off by the secretions, or artificial evacuations, and the gland returns to its natural state; but the disease has greater tendency to suppuration, than to any other kind of termination, and is less disposed to gangrene than other phlegmonous inflammations. The liver is found most frequently mortified in the plague, and putrid diseases, where inflammatory symptoms seldom arise to great height.

CHRONIC OR OBSCURE INFLAMMATION, the general concomitant of indurated and obstructed states of the liver, is often induced without active inflammation, and is therefore attended with little or no fever in the early stages; although much depends on the intensity and extent of the disease. Whether the liver be totally or partially affected, and whether the disease be in the circumference, or interior of the organ. The liver, a net-work of blood and lymphatic vessels, favors the deposition of various kinds of diseased matters into its substance, according to the specific action of the depositing vessels, and the general disposition of the gland at the time. This is most commonly a lymphatic deposit, which is at first local, while the rest of the gland continues in its natural state, but induces a degree of irritation or chronic inflammation, which extends the disease, and occasions its induration by increased deposition; but it advances slowly to suppuration, from the natural insensibility of the organ. When a great portion of the liver is schirrous, a slight degree of fever, with a fulness and obtuse pain of the side, take place, often described by patients, as a numbness or weight of the part; but in a few instances, the pain is felt on the left side of the body. If the concave part of the liver contiguous to the stomach be diseased, vomitings

and disturbed digestion are liable to occur. In the course of the disease, especially when the right lobe is the seat, the liver may be felt hard and ponderous, externally; but if the left lobe, which is equally liable to disease, be only affected, the margin of the liver cannot be felt. In the beginning of the disorder the liver is generally situated high in the thorax, but in the progress of the disease it contracts by absorption, and descends so low, that the great margin can be felt by the fingers, below the false ribs, in a callous state. And it may be made to descend two or three fingers breadth lower, by placing the patient in a sedentary posture, with the body a little bent forward, and making him fetch a deep inspiration, especially in the empty state of the stomach, than when he is placed in the horizontal position, or with his stomach distended, which are less favorable to the discovery of diseases in the liver, by external examination.

An indurated state of the liver is perhaps one of the most common diseases of the East Indies; and often of such an indolent nature, that persons are afflicted with it for many years together, without knowing what their disorder is. They complain at first of diminished appetite—nausea—bitter taste of the mouth—low spirits, accompanied with foul tongue—sallow com

plexion—yellow eyes—and frequently with uneasiness of the right side; which symptoms they are apt to impute to a bilious habit only, but by continuing in warm climates, the disease proceeds to a fatal termination; whereas in Europe, by careful living, and the occasional use of evacuating remedies, those invalids may live as long as if they had no such disease. In the progress of the disorder, suppuration takes place, and brings on hectic fever; or the enlarged liver presses upon the bile ducts, and occasions jaundice. Sometimes, pressure on the thoracic viscera injures the vital function; at other times it compresses the thoracic duct and large blood vessels, so as to induce swelling of the lower limbs, and a train of dangerous hydropic symptoms, which make their appearance in different cavities. This schirrous state, which usually proceeds to suppuration, has been known in a few instances, to terminate in ulceration and cancer.

THE SUPPURATIVE STATE OF THE LIVER is a frequent consequence of the former disease; but it is likewise common for abscesses to be found in the interior substance of the liver after death, where patients never complained of pain of the part during life, nor were suspected to have inflamed livers.

Two cases, communicated by the author's brother to the medical society of London, were published in the third volume of their memoirs. A patient in Jamaica died of consumption of the lungs, where the liver was unexpectedly found in a complete state of suppuration; and a woman died suddenly in labour, from the bursting of an abscess in the liver: neither of which diseases were known to have existed in that organ before death.

The mildest state of suppuration, where vomicae, (or small portions of matter form cysts round themselves by pressure,) continue for the most part, for years, without molesting the general system. When these become large abscesses, they are apt to discharge themselves into the nearest cavity, or bring on hectic fever and jaundice, which rapidly destroy the patient. But many such patients are saved, by hepatic flux supervening, and by the bursting of the abscess into the gall ducts or colon, or discharging itself externally by an opening in the parietes of the abdomen.

Although the different chronic inflammations of the liver do not prove immediately fatal, yet they for the most part injure the digestive powers, and oblige invalids to have recourse to frequent means of depletion. Cheltenham water operating as a diluent, facilitates the passage

of the bile from the ducts, and lessens the febrile action of the system. The waters of Bath, which are also used as diluents, cannot be employed with the same freedom, in cases of great irritation or hectic fever, like the neutral salts dissolved in a large portion of cold water, from the wells of Cheltenham. The Saline waters will also act by their purgative properties, by promoting absorption of diseased matter, and emptying the bile ducts. They can also be made to co-operate with, or to succeed, the use of mercury, in chronic inflammations of the liver, where patients cannot always continue in the use of that powerful remedy.

TORPOR OR PARALYSIS of the vessels of the liver is one of the most frequent bilious diseases met with in this country, and is seldom attended with much inflammation or pain. Habits of spirituous potation, or the constant ingurgitation of any other powerful stimulus, destroy the stomach, and change the structure of the liver in a slow and gradual manner.

Dram drinking injures the liver more than it does the stomach, from the latter possessing greater power of sensibility and muscularity, to recover its lost tone; besides numerous absorbents pass from the stomach and intestines through the liver, which in hard drinkers convey the stimulus of alcohol in a direct manner to it;

and thus the ancients enlarged the livers of geese, by mixing spirits with their food, and hogs have acquired swelled livers, by feeding on brewer's grains. The author was lately called to two farmers, who died of the consequences of hepatitis, from drinking largely of home-brewed ale only, which was little stronger than good table beer. One of them drank ten or eleven quarts daily, producing continued slight inebriation for several years together, but had scarcely ever tasted spirituous liquors.

In all these cases of the continued use of unnatural stimulants, although the liver may frequently escape from schirrus, yet it becomes debilitated, and secretes less bile, the ducts get thick and contracted, and the bile is transmitted in diminished quantity, or in viscid state, to the alimentary canal. Langor—nausea—diminished appetite—indigestion—fulness of the region of the liver—sallow complexion—heavy eyes—and constipated bowels succeed; and are too often followed by marasmus, schirrus, and dropsy. Gouty persons are also subject to paralysis of the liver, in the absence of the inflammatory paroxysms.

In like manner, long residence in tropical climates, occasions the paralysis of the branches of the porta, so often found among the visitors

at Cheltenham. It is evident, that a rapid secretion of bile long continued, like other profuse evacuations, must weaken the vessels of the liver by repeated action, as well as by excess of the discharge, and produce a permanent predisposition to derangements of the alimentary functions. Hence, it is not uncommon for invalids, after they arrive from the tropics, to be troubled with bilious symptoms, from the want of their accustomed stimulants, viz. atmospheric heat, and high seasoned dishes, without our being able to discover any organic disease, except a paralytic state of the liver; manifested by corporal debility, and mental langor, and by a train of dyspeptic symptoms.

In the same way, continued anxiety, grief, or other depressing passions, which diminish the velocity of circulation, debilitate the hepatic system, and produce a train of torpid actions.

CONGESTIONS OF FLUIDS are common occurrences in the liver, although they do not always disturb the functions of the organ. Sudden derivations of blood to the liver—torpor in the branches of the porta—diminished proportion of its secretion—or a viscid state of the bile, are liable to produce accumulations of fluids within the vessels of the liver, or depositions into its parenchymatous substance; and that such states frequently exist, independent of inflam-

mation, comes within general experience, and is amply confirmed by dissections.

Sanguineous congestions are most common. No organ receives such different proportions of blood, and has a structure so much adapted to these congestions, as the liver. The area of the hepatic veins which carry away the blood, being so much smaller than that of the vessels which supply it, that we often find free living—lingering intermittents—transferred gout—suppressed evacuations—and repelled eruptions—producing fulness, and uneasiness of the epigastric, and hypochondriac regions, and at times, rendering them tumid externally;* and this is the reason that discharges of blood by the hæmorrhoidal vessels, (which are distant branches of the vena porta,) and that diarrhœas, are so frequently critical in diseases of the organ.

Serous congestions are not uncommon. The substance of the liver is often found in a soft, and œdematous state, which sometimes terminates in ascites. A case lately occurred to the author, of a female attacked with fever, and pain of the right side, who passed several whole

* The liver is often found on dissection, tumid, soft, and dark colored, in scorbutic patients, putrid fevers, and in those who have died with dilatations in the right auricle of the heart.

hydatids by stool, which recovered her entirely from the deranged functions of the liver.

Bilious congestions are often found diffused in the substance of the liver, and the *pori bilarii*, and the roots of the hepatic duct gorged with bile; hence the numerous cases of small gall-tones found in the substance of the liver, and impacted in the duct near its origin. They are sometimes found in great masses destroying the substance of the liver.

Lymphatic congestions are found in the liver, of different kinds. The organ abundantly supplied with lymphatic vessels, the lymph is often deposited, and concreted—hence the many instances of hard tumors, and of tubercles, found in the liver upon dissection, particularly of scrofulous patients.

Besides these general affections, which disorganise the hepatic system, an infinite number of depositions, and local lesions, are found upon the dissection of bodies, in the liver and gall ducts, which afford no discriminating symptoms, to indicate their existence in the living body.

Various Tubercles, of a firm circumscribed nature, are found in the substance of the liver, which although small at first, by an inherent growth form large masses, and supplant the natural structure of the gland. One species, of a

brown or yellow solid matter, is extremely common in hard drinkers. It is found, from the size of a millet seed, to that of a hazel nut, occupying the whole mass of the liver by its numbers, so as to occasion a degree of induration, which has a resemblance to the schirrus of the organ. Another tubercle of a white color, at times as large as a chesnut, produces a still greater resemblance to the true schirrus of that gland.—And scrophulous tubercles, like those of the lungs, in size, appearance, and structure, but more diffused through the substance of the liver than the other species, are often of a fungous nature, and containing pus. None of those are attended with much pain, but they induce a state of chronic inflammation—sallow complexion—and frequently a degree of permanent jaundice, by pressing on the biliary vessels.

Numerous other productions and malformations, are recorded by writers on morbid anatomy, which cannot be considered in a treatise of this kind.*

* The following are the principal ones.

Stones—and cancers in the substance of the liver. *Boneti sepulchretum*, an. 1700, tom. 2. sec. 17. Frequently a flaccid—œdematous, structure of the liver—dropsical hydatids—worms—and polypi. in it. *Bianchi Historia Hepatica*, 1725, tom. 1. part 2. c. xi. The liver swelled—greatly contracted—covered with white scabs—*Lieutaud Historia Medica*, 1767, tom. 1, sect. vi. The liver as if boiled—extending

The constitutions of patients usually afflicted with torpor, or congestion of the liver, not being able to bear the lancet, or violent evacuations, and the sensation of fulness in the hepatic system, suggesting the necessity of a purging plan, they generally find their way to Cheltenham, for the benefit of the waters and climate. The Saline waters drank daily, or three or four times a week, will remove plethora and fulness, from the hepatic organs, and at the same time free the stomach from states of distention, which must aggravate the complaint, and press the liver upwards, to the detriment of the vital organs in the thorax.

But in all these diseases, as well as in chronic inflammations of the liver, exercise in the to the left side—frequently displaced—adhering to neighbouring organs—deeply subdivided—double—gorged with steatomatous matter—and containing white schirri. The gall bladder wanting—its coats thickened—remarkably thin—contracted—dilated—distended with bile—and often containing calculi. *Morgagni*, 1769, *Epist.* 3, 7, 22, 24, 29, 30, 39, 47, 48, 57. The coats of the liver cartilaginous—its substance soft—hard—ruptured—ulcerated—containing cysts of earth—tubercles of the common—large white—soft brown—and scrofulous kinds. The gall bladder wanting—containing hydatids—its coats adhering to other organs—boney—schirrous—the coats obliterated—dilated—and ulcerated internally. *Baillie's Morbid Anatomy*, 1809. The circumscribed or white tubercle—the diffused or scrofulous tubercle—*Dr. Farre*, 1812.

air should be joined to a course of the waters, which will invigorate the habit, promote the absorption of fluid, or indurated matter in the substance of the organ, and expel the stagnant fluids that obstruct the biliary passages. The hepatic vessels in their soundest state, are of so torpid a nature, that respiration and the action of the abdominal muscles, are essential to the circulation of the blood through them, as well as for the passage of bile through the inert and passive gall ducts; how much greater then, is the necessity of muscular movements, when the torpor is increased by diseases? The author considers exercise on horseback, which agitates both the muscles, and internal viscera of the trunk of the body, to be the most effectual of all remedies, that can be conjoined with Cheltenham water, for paralysis, states of congestion in the vessels of the liver, and depositions into its substance.

SECT. II.

DISEASES WITH A DERANGED STATE OF THE BILE.

Besides the diseases arising from a morbid change of structure in the liver---numerous others depend upon the derangement of its secretions.

Bile is a fluid so readily soluble in water, and so easily coagulated by acids or alcohol, that physiologists have been able to ascertain its nature by chemical analysis: in its usual state, passing into the intestinal canal, it is a viscid green fluid, which consists of water, biliary matter, and alkaline salts, with some mucus from the gall bladder; and it possesses a bitter, antiseptic, and soapy property.* Some authors have likewise consigned it a share in the nutritious process, by separating the chylous from the fæculent matters of the alimentary canal; for without doubt, the biliary matter imparts the chief darkness to the contents of the lower part of the tube, and not to the chyle. But the most important use of the bile, is, to stimulate the bowels to perform their peristaltic motion; absolutely necessary for digestion, and for carrying the food regularly through the body. It is not however a strong stimulant to the alimentary organs in their sound state. The author administered in several cases, from 25 to 35 grains of bile, (taken from the human subject and oxen) made into pills. This never produced more than one laxative evacuation, except in one patient, who, during the hot season being in a feverish habit

* Berzelius on Animal Fluids 2. vol. Annals of Philosophy, says, bile contains no resin, but a peculiarly bitter substance soluble in water, and alcohol.

of body, was considerably purged by a dose of that strength. Neither does bile stimulate the vital organs, or other parts of the animal body, than the alimentary canal. On the contrary, when the blood is saturated with bile in cases of jaundice, the pulse becomes slow, and the moving powers torpid. In like manner, when a patient lives long enough to be completely jaundiced, he generally recovers from the yellow fever in the West Indies.

Symptoms indicating derangement of the biliary secretion, attend almost all diseases of the alimentary organs, either from the superabundance, deficiency, obstruction, or vitiation of the fluid.

DISEASES WITH INCREASED FLOW OF BILE.

This is the consequence of continued atmospheric heat, or of vascular irritation in the liver. Bile is naturally secreted in greater abundance than any other fluid of the human body, except the urine and perspiration. But in cases where the circulation of blood is greatly hurried, especially through the liver, the bile will at times pass from the ducts in a full stream, and in a thin crude state. The author has seen more than a quarter of a pint of bile, vomited every half hour for days together, in fever, at

the time the patient could retain no drink upon his stomach five minutes. In most cases of increased secretion, and without fever, the alimentary organs becoming surcharged with bile, have their functions greatly disturbed. The body is sometimes constipated, but for the most part the alvine discharges are increased, and of a dark color. The blood in these cases is liable to be saturated with bile, and the numerous absorbent vessels in the liver and gall bladder, transmit it to the serum of the blood, which tinges the eyes, skin, and urinary secretion more or less yellow.

A BILIOUS STATE OF THE STOMACH is one of the most common effects of superabundant bile. On passing rapidly into the duodenum, great part must be regurgitated into the stomach, since the opening of the common duct is within a few inches of the lower orifice of that organ; and we have likewise reason to believe, that copious discharges of thin bile, stimulate the duodenum to contract, which must force bile into the stomach, particularly in the morning, when the stomach is empty, and the gall-bladder surcharged with the secretion.

Bile collected in unusual quantity in the stomach, induces the following dyspeptic symptoms: Loss of appetite—nausea—flatulence—foul tongue—bitter taste of the mouth—thirst—

tendency to vomit—fulness of the epigastric region—pain of the stomach—low spirits—frequently heaviness and bilious turgescence of the eyes—and scanty high-colored urine. Bile is so abundant in hot climates, as to be ejected both upwards and downwards, without any existing disease. The author has known numerous instances of people in Jamaica, who were obliged to take the juice of one or two large oranges every morning on first waking, to neutralize and carry off the bile. It also forms a neutral salt with the acid of the stomach, when superabundant, and occasions frequent green stools, particularly observable in children during the lactescent period. Biliary matter not entering the circulation, the contents of the alimentary canal become dark, in proportion to the abundance of bile and acid in them, so that we possess the means of ascertaining both the state of the biliary secretion, and of the stomach at the same time, by attending to the appearances of the alvine discharge.

Cheltenham waters are more serviceable in removing the excess of bile from the stomach than most other remedies, but they ought to be drank in small doses, that it may be able to retain them. There will be frequent occasion to take the water warm in this state of the stomach, otherwise it might be rejected, and much vomit-

ing should never be encouraged, as in all cases of redundant bile, the proper exit is downwards.

SICK HEAD-ACH, accompanied with bilious vomitings is a disease often met with in medical practice, but has only been lately noticed as idiopathic by Dr. Fothergill.* It appears to arise from a periodical accumulation of bile, and the author has had several patients of bilious habits labouring under the disease, after long residence in the West Indies. Violent head-achs return every three or four weeks, affecting the eyes almost to blindness, accompanied with sickness of the stomach and generally with vomitings of bile, which continue from one to three days. Females, who are the principal sufferers bring it on, or render the paroxysms more severe, by fatigue, costive bowels, and irregular modes of life, particularly on the approach of the monthly periods.

This habitual disease is difficult to cure, but receives benefit from emetics, and laxative medicines, administered before, or in the beginning of the paroxysm. The author has lately seen several patients derive advantage from the use of the waters in this disease.

CHOLERA MORBUS, the autumnal epidemic of Europe, is a notorious instance of redundant

* The posthumous works of Dr. Fothergill, published by Dr. Letsome in 1803, page 219, vol. III.

bile, and often of a diseased nature. It attacks the constitution excited by summer heat, with sudden loss of strength, fever, and bilious vomiting. The peristaltic motion of the intestines, which naturally proceeds from the stomach downwards, is at times inverted through the whole canal, so that its contents are returned upwards; but at other times it is attended with purgings. Although in Britain this is commonly a mild disease, yet it sometimes is extremely violent, attended with spasms in the calves of the legs, and a feeble contracted pulse, which has been known to terminate in dysentery or jaundice, and even to kill the patient in two or three days.

Cheltenham water cannot be used in this acute disease; indeed, in every case of inverted intestinal motion, bulky nauseating remedies, which increase the exertions of the stomach, should be avoided.

BILIOUS DIARRHEA, is another instance of redundant bile. Nausea—foul tongue—bitter taste of the mouth—and frequent alvine dejections take place, without gripes or fever. Spontaneous diarrhea is most commonly an effort of nature to carry off superabundant bile, or to effect the crisis of other diseases.

Small portions of Cheltenham waters may be useful in many cases of diarrhea, to expedite

the removal of bile from the system, but it will be more so when employed as a previous step to checking the disease, by opium or astringent medicines. Bilious patients, however, can seldom bear violent purging, and the author has known a single copious evacuation of bile, produce a great degree of langor, in the advanced period of life.

DYSENTRY. Sanguineous flux is so greatly connected with excess of bile, that it commonly occurs in climates which produce violent bilious diseases, and in Europe in camps and fleets, in the autumn of the year, when bilious diseases are most prevalent. It is often attended with a morbid condition of the liver, but we cannot consider the state of the biliary system as the cause of a disease propagated by contagion, although it undoubtedly disposes to its attack.

The chronic state of the disease is frequently brought from abroad. The acute symptoms of fever—gripes—tenesmus—and sanguineous dejections having subsided, irritability, or ulceration of the large intestines with frequent mucous evacuations, continue for months, or even years, until patients resemble walking skeletons.

The intestines not being able to clear themselves, tenesmus, a principal symptom of this disease, takes place, which renders the occasi-

onal use of laxatives, particularly of neutral salts, necessary to clear the upper part of the intestinal canal, and to increase the secretion from the glands, without gripes ; but the steel waters will be more likely to remove the morbid irritability of intestines, in habitual fluxes.

BILIOUS FEVERS, the scourge of tropical countries, are attended with vomitings, and jaundice, from excess of bile, and they now and then occur in Britain in the autumn of the year, after a sultry season. But it does not appear to the author, that they arise from an acrid state of the bile, so much as from a morbid irritability of the alimentary organs, which had taken place in them, previous to the vomiting. The appearance usually ascribed to acrid and putrid bile, in these diseases, must therefore be imputed to the state of the alimentary tube and liver ; and at the same time to the febrile condition of the body, increasing the flow of bile, which becomes putrid by increased heat, like any other fluid detained in an inflamed part.

Medical practice in tropical countries, where fevers are always attended with excess of bile, consists almost entirely in the free use of bitter laxative drinks, to remove bile, and allay the febrile action of the system. The author had seventy patients every day under his care, in

Antigua Hospital in the West Indies, who were either afflicted with Bilious fever, or dysentery, and as their stomachs could retain nothing solid for a minute, he followed the practice of that hospital, which was to give them, indiscriminately, as much cold water, wherein a log of quassia wood had been steeped, as they could use. The effects of that portion of the bitter laxative, which remained upon their stomach, were to wash away the bile, and to invigorate the habit, sinking under the fatigue of perpetual vomiting.

In like manner the practice of the ancients in Europe, was, to give large draughts of cold water to check the vomitings of intermittent fevers. The author has always found cold water, corrected by a bit of toasted bread, to be one of the most useful drinks in bilious vomitings of every kind. Although Cheltenham water cannot be administered in acute fevers, these facts sufficiently prove its utility in feverish states of the body, accompanied with excess of bile, in this climate; but it must always be kept in mind, that smaller portions of purgatives, will operate upon the bowels which are irritable, and where bile is redundant, than in most other cases.

DISEASES WITH DIMINISHED FLOW OF BILE.

Diminished secretion of bile is as much the consequences of coldness of climates, as its increased flow is of their heat, and its deficiency is not a less frequent concomitant of disease.

The secretion may be lessened by diseases occupying the place of the secreting vessels in the liver, as happens in its schirrous and suppurative states ; by debility and torpor of the hepatic vessels, from the habitual use of internal stimulants ; or from long residence under a vertical sun ; which states of the body have already been considered.

It may likewise be lessened by a sympathetic action between the gastric and hepatic systems, from their mutual subserviency to the nutritive process. And also by general torpor, diminishing the circulation of the blood, in the melancholic, and chlorotic temperaments.

Any of these causes may diminish the secretion of bile or render it viscid, which will deprive the alimentary organs of their due proportion of natural stimulus, and occasion diseased action of the system.

DYSPEPSIA. Indigestion is at different times combined both with a redundant, and a deficient flow of bile. But the dyspepsia of this country is most frequently attended with the

latter state ; since costiveness, from diminished peristaltic motion, is the most usual symptom accompanying it.

It is never long confined to the digestive organs ; the liver and its secretions are brought into consent. The bile becomes deficient, or flows irregularly. The relative situation of the organs subservient to nutrition, is admirably contrived by nature. The bile collected in the gall-bladder during the empty state of the stomach and duodenum, is forced from it when they are distended, at the precise time it is wanted for the digestion of a full meal. In like manner different states of distention constantly occurring in the stomach, and transverse arch of the colon, from disengagement of flatus in dyspepsia, produce such different degrees of pressure on the liver, and its excretory channels, that the body is sometimes purged, although for the most part costive ; and the evacuations artificially procured, are frequently frothy, greasy, and of grey appearance.

Cheltenham waters are more used for states of indigestion, than for any other diseases, and generally with the happiest effects. They encrease the peristaltic motion, and solicit a flow of bile, while at the same time they strengthen the stomach, and remove the fœculent part of the food ; the consequences are, that invalids

seldom drink them ten days together, without experiencing some improvement of appetite. Nausea and vomiting are also powerful stimulants of the liver and ducts, hence the improvement of the appetite and healthy action of the biliary system, which take place from sea sickness.

HYPOCHONDRIA. The hypochondriac disease is another state of dyspepsia, accompanied with dejection of mind, and diminished flow of bile. It occurs most frequently in the melancholic temperament, which is characterized by general torpor, sluggish secretion, and costive bowels.

But stomach complaints scarcely ever arrive at great height, in any state of the constitution, without affecting the mind. Hence flatulency—distention—acidity—costiveness—wakefulness—and erratic pains about the ribs, are usually accompanied by langor and a melancholic state of mind, turned inwards upon the bodily sensations. The immense volume of air extricated from a small portion of food in dyspeptic diseases, by distending the great arch of the colon, produces so much uneasiness, that it often increases the alarms of the patient about the nature of his disease. No doubt a lax and flaccid belly, and a clean tongue, always afford

the best presages, in diseases of the trunk of the body.

The intimate connection subsisting between body and mind, is in nothing more remarkable than in the effects of the depressing passions upon the stomach and liver. Bad news will instantly remove the keenest appetite, and produce a pain of the stomach ; while grief diminishes the flow of bile as suddenly as a paroxysm of anger increases it. Many persons find their way to Cheltenham with the nervous system deranged, and the mind depressed from unprosperous affairs, or loss of friends : Dyspepsia, the consequence of this disease, reacts upon the sensorium, and disorganises the biliary system.

As hypochondria is often attended with fullness of habit, and with viscid or deficient bile, gentle evacuating remedies, become as necessary for the cure, as tonic ones. Hence the astonishing number of patients who receive relief in this disease from Cheltenham water, conjoined with exercise on horseback, and with novelty of scenery in the place.

MANIA occurs most frequently in the melancholic temperament. A dark complexion, with dark or black hair, and a costive state of the bowels, characterize the constitutions of two thirds of insane persons.

The connection of this disease with a peculiar state of the liver, which constitutes part of the hereditary disposition to it, is confirmed by the great number of diarrheas, and dysenteries, supervening to madness; by hæmorrhoidal discharges of preceding convalescence; and by the general utility of drastic purges and emetics, in curing the disease.* But we cannot consider Cheltenham water as at all applicable to any state of mania.

CHLOROSIS, a morbid irritability, which disturbs the healthy actions of every part of the female constitution, between the ages of 17 and 25, is accompanied with deficiency of bile, from languid circulation in the liver.† To avoid the mischief that might arise from mistaking the disease for a jaundiced state of the body, it must be observed, that there are no appearances of absorbed bile in the eyes or urine. The green hue and paleness of the skin, depend upon a paucity of red globules in the blood; which imperfect state of sanguification is greatly increased by defect of bile in the intestinal canal.

The general weakness and inactivity of the

* Vide Haslam's valuable Observations on Madness, 2d Edition, 1809.

† "Those persons who secrete least bile, have a sanguineous complexion, soft hair, and lax fibre, in whom the sanguific powers are weak, as in chlorotic females."—Dr. Saunders on the Liver, p. 161.

system, together with the dyspeptic and œdematous symptoms which attend the disease, indicate the employment of the most powerful tonics, in preference to purging waters; but there are not wanting instances of chlorotic patients deriving benefit from the salubrity of the climate, and the occasional use of the waters of Cheltenham.

DISEASES WITH OBSTRUCTED BILE.

Interruption of the bile in its passage from the liver to the intestines, occurs more frequently in Britain, than in tropical climates, most probably from greater viscidty of bile. Besides the train of dyspeptic symptoms, which depend upon deficiency of bile in the alimentary canal, another set takes place, from its absorption into the blood.

We judge of the absorption of bile into the circulation, by the yellow color of the eyes and skin. But this is not at all times, and in every part of the body the same. In jaundice it is discovered chiefly in the eyes and face. In febrile diseases it is more in the skin of the body; and in some cases it appears in irregular tints, interspersed over different parts of the surface. But in general it is first discovered tinging the serum of the blood in the white

tunics of the eyes, and passing from the system in the transparent urine.

The following diseases are notorious instances of obstructed bile; and it is remarkable, that the same cause should produce such different sets of symptoms, at different times.

GALL STONES passing the ducts, occasion more violent symptoms than those of jaundice, and are sometimes attended with a feverish habit of body, but with no great yellowness of the skin, until the stone has come away.

The author has seen some instances of a chronic state of this disease, where the patient had ill health, and the concretions remained quiescent for several years. The symptoms of dyspepsia—fulness at the region of the stomach—uneasiness when it was empty—irregular bowels—dark sediment in the urine—and sallow complexion, were ascribed to a bilious constitution, but terminated suddenly by passing gall stones, with paroxysms of pain and spasm.

When biliary concretions are entering the intestines, there generally occurs a deep seated pain, darting from the pit of the stomach to the back bone, and sometimes extending to the right shoulder and arm. The ducts are not very sensible, and admit of so much dilatation, as now and then to permit a stone to pass, as large as a pigeon's egg, the pain is

generally felt at the narrow and less dilatable opening of the common duct, between the irritable coats of the duodenum. It is therefore often so intense as to bring the whole system into sympathy, which endeavours, by repeated paroxysms like those of parturition, forcibly to expel the foreign body ; so that vomitings—hiccup—chilly fits—contracted pulse—and convulsions—sometimes succeed.

In a few days, when those symptoms suddenly disappear, a small, soft concretion, perhaps no bigger than a pea, and often of a white color, or with a bilious tinge, may be found in the alvine evacuations, by passing them with water through a sieve. Sometimes granules, like indurated bile pass, and other times a soft brown substance like calcareous matter, by the alvine evacuations. But as in most cases the gall bladder contains others, the disease is very apt to return after a time.

Gall-stones sometimes have been discovered by dissections, filling the gall bladder, and the substance of the liver likewise, which were not known to have existed during life. They are as common in this climate as urinary calculi, and are seldom found in the hepatic ducts, where the bile is thin, but mostly in the common duct, where it is viscid. Some of the calculi are formed in thirated rays, of different

colors; but however they differ in hardness, shape, color, and size, there is no essential difference in their nature. They are all bitter, and consist of crystalline layers formed on a nucleus of bile; they dissolve in the same fluids, most of them inflame, and a great number swim in water. A viscid state of the bile from cold or inactivity, favors their production. Hence they are extremely abundant in the gall bladders of horned cattle, between the months of November and March, when the season is cold, and the cattle confined to the stall.

Cheltenham water can be of little service in the painful paroxysm of passing gall-stones. Relaxants, of the most powerful nature, are generally resorted to. But in chronic cases, they may be drank with as much success, as any remedy whatever, with a view to promote their dissolution, but more especially to facilitate their passage from the biliary channels, and to obviate distention of the abdomen, with other dyspeptic symptoms, which always attend obstructed bile.

JAUNDICE is not a disease of the bile, and seldom of the liver. Its occasional occurrence from paroxysms of passion or hysteria, has been explained by spasmodic contraction of the common duct; from dram drinking, by thickening of its coats; from enlargement of the liver, by its

pressing on the gall ducts, and in early infancy from mucous fluids choaking the mouth of the duct.* But four times out of six its occurrence in the progress of life, arises from biliary concretions obstructing the gall ducts. It is therefore seldom fatal, when the glandular viscera are sound; but when schirrosities of the pancreas or liver produce jaundice, dropsy is liable to supervene. There are many instances of jaundice, happening with a pervious state of the ducts, and the patient not at all costive. In the bilious and yellow fever, the bile is secreted so profusely, that the area of the excretory channels seem hardly sufficient to permit its free passage to the intestines.

A variety of character no doubt arises from these different causes, but the most common symptoms in the alimentary organs, are a deep seated pain in the epigastric region, which patients at times describe as a faintishness, and sinking at their stomach; and at other times;

* The jaundice so frequently occurring immediately after birth, is so little of a disease, that it disappears spontaneously, or by the administration of purgatives, in a few days. And the author considers it as arising from the sudden change in the distribution of blood, by the division of the umbilical chord. The excess of bile and copious green stools, natural to the early part of the infant period, is owing to the overproportioned liver, and velocity of the circulation.

as an excruciating pain extending to the back bone, and down the abdomen, without much alteration of the pulse from its natural state.— Since neither the liver, gall-bladder, nor ducts, are irritable organs, the cause of the pain has been explained, by calculi distending the common duct at its oblique entrance, between the irritable coats of the duodenum; but it is a remarkable fact, that the pain is generally felt at the pit of the stomach, although the opening of the common duct into the duodenum is considerably to the right side of it. The deficiency of bile in the intestines occasions a great variety of dyspeptic symptoms, and when the obstruction of the duct is complete, an obstinate costiveness, with white or clay-colored evacuations, take place; but many cases have occurred to the author, of jaundice without any appearances of obstructed ducts or constipated bowels; the alvine evacuations, however, were generally white or grey, and the urine high colored. The symptoms from the absorption of bile, are, general torpor—loss of strength—low spirits—slow pulse—yellow eyes and skin—red colored urine—tenderness—pain on pressing the epigastric region—cuticular eruptions and itchings of the skin—and the appearance of bile in all the secretions, except the milk.

The best remedies are emetics, to accelerate the circulation in the liver, and force the biliary passages by compression and percussion; but purgatives are also necessary, to stimulate the intestines to discharge their fluids. Cheltenham water will answer this indication, and by its attenuating properties, help to dissolve the obstructing cause; but it will more effectually relax the ducts when taken warm, than in its cold state.

DISEASES WITH VITIATED BILE.

The enthusiasm of ancient Physicians, in ascribing malignant fevers, vomitings, colics, and fluxes, to acrid and black bile, was very general. But most modern ones, consider these diseases to arise from a morbid condition of the solids; and ascribe the vitiated appearance of the bile, to the escape of blood from debilitated vessels, in putrid states of the body, or to the union of carbonaceous matters with the bile, in the alimentary canal.

The bile in its natural state is an antiseptic, which obviates the tendency of the aliment to run into the putrefactive fermentation; and the blood saturated with bile, for years together, in cases of jaundice, does not turn putrid. The black color it acquires in diseases, commonly arises from its union with blood, or from the

heat of fever. At the same time, bile naturally of a dark green color, when superabundant, like the red particles of blood, gives a deep tinge to a great quantity of other matter. But in temperatures above a hundred degrees of Fahrenheit's scale, bile turns putrid in a short time, and becomes black, and offensive to the smell; this degree of heat however, is greater than the standard heat of the healthy body in any climate.

Bile in its healthiest state, varies considerably in consistence and bitterness. These are less, when the liver is strongly excited to action, than when it is in a torpid state; when it flows in the hepatic duct, than when it has suffered remora in the gall bladder; and when it is diluted in the duodenum, with the salivary fluid of the pancreas, than when it passes the common duct. These facts enable us to explain the different predispositions of the body to specific diseases, in tropical and cold countries.

A gradual and constant application of intense heat to the human body, imperceptibly changes the state of its stamina, by inducing relaxation and debility, and so predispose the habit to putrid, and bilious diseases. Thus, a greater external circulation of blood, and increased discharge from the cuticular pores, are general conditions of the system in hot climates ob-

servable by an increased sensibility of the skin to external cold, and by a constant moist state of the surface, requiring change of linen once or twice a day.* This exterior circulation exhausts and weakens the interior vessels of the body, from which vital energy and strength are chiefly derived. While at the same time, the increased circulation of blood in the liver, from heat, augments the secretion of bile, by which means it is transmitted more copiously to the alimentary organs in a thin and crude state, so as to irritate them, particularly in their excited state. But tropical diseases seldom occur, even in the predisposed state of the body, until a morbid irritability, or an erisipelatous inflammation has taken place in the internal membranes of the chylopoetic viscera, which subjects them to receive supernatural stimulus from their own fluid, in a manner similar to what happens in catarrh, with the mucous membrane of the throat, when inflamed, the disease is increased and propagated by the ir-

* Heat suddenly applied to the body, produces more dangerous effects. The constitution not having time to accommodate itself to the climate, the quick transition from Europe to the West Indies, in a few weeks, induces the yellow fever, so fatal to Europeans on their first arrival. Whereas, those persons who perform a voyage of five or six months to the East Indies, are not liable to that disease.

ritation it receives from its own secretion, which differs only from its natural state in quantity and increased tenuity.

Without entering into the controversy, concerning bile as a cause or symptom of disease, we can freely state our complete evidence of its existence in a vitiated state, in a great number of instances. In dyspepsia, bile is often thrown up with the contents of the stomach, in a highly acrid, and corrosive state. Bile is vomited in cholera morbus evidently diseased, and sometimes with as great rapidity as if a patient swallowed poison. Copious discharges of fetid and putrid bile, are not uncommon occurrences in fevers of the putrid, bilious, and remittent kinds, as well as in the plague, colics, diarrhea, and dysentery. In some diseases, the bilious evacuations resemble the washings of flesh, and in others they excoriate the anus. Cuticular eruptions, and itchings of the skin often take place, from absorption of bile in jaundice, to such a degree as sometimes to have puzzled the author to distinguish them from the real contagious itch. Biliary calculi are generated from viscid bile, and from a peculiar disposition of its elements to crystallize, in cold countries. Numerous other instances might be adduced, if it were necessary, to prove the degeneracy of bile.

The different appearances of the bile itself in color, taste, smell, and consistence, indicate a difference in its properties. Morgagni relates the case of a painter, who died of convulsions, after a tertian fever, where the intestines and stomach were found on dissection loaded with eruginous bile, of such an acrid nature, as to corrode the scalpel, and poison animals.*

The opinion of the ancients concerning the destructive properties of bile, was greatly confirmed by the utility of purgative medicines in the cure of malignant diseases; and there is no doubt, but the saline waters of Cheltenham are of great service, in removing acrid and vitiated bile from the alimentary canal; while at the same time they increase the demand of the system for new matter, to secrete healthier fluids.— Upon these principles, we explain many of their excellent effects in most bilious diseases of a chronic nature.

* Morgagni relates different dissections where the bile was white, saffron-colored, brown, red, green, black, fæculent, viscid, sandy; and where the gall-bladder, ducts, stomach, and intestines were loaded with acrid bile, like ink. *Tom. iii. Epist. 59. Art. 18. Tom. ii. Epist. 30. Art. 16.*

CHAP. IX.

ON

THE BATHS, AND BATHING, AT CHELTENHAM.

Hot and Cold Baths have been in use at the top of the town of Cheltenham, since the year 1787; and are well known to have been conducted with skill and attention by Mrs. Freeman; who still continues the business in that situation; and likewise performs the operation of cupping with uncommon dexterity. These are extremely commodious for sick people.

As new baths are completed upon a larger scale, by Henry Thompson, Esq. on the south side of the river Chelt, opposite to Cambray, it will not be inexpedient to state their conveniencies.

There are six baths, two of them cold, and the others tepid or hot, with a cold shower-bath attached to each. These are ready for use

at all times of the day, from seven in the morning till seven at night, and in every season of the year. Four of them are built of stone, with smooth stone bottoms, and are large enough to swim in, which prevents the confinement of the body, particularly detrimental to it when immersed in a cold fluid.

They are lighted and ventilated from the top of the building; hence, the bathers cannot be overlooked; and the internal atmosphere is preserved in so pure a state, that steam never appears, even on the surface of the hot-baths, until the temperature of the water exceeds 96° of Fahrenheit's scale.

The water is preserved in the baths at the uniform height of four feet and a half, and continually flows into them by pipes of cold water and steam; and out of them by a waste pipe of an inch and a half diameter. They are besides completely emptied every two or three days, and filled again in the space of an hour; by which means the water is always fresh and pure in the baths.

The baths, are heated in a rapid and uniform manner, by a plan suggested more than sixteen years ago by the celebrated Count Rumford, to heat baths with steam.* The steam is con-

* Count Rumford's Essays, 1802, vol. iii. Ess. xv.

ducted by a large iron tube, from the boiler in the engine house which prepares the salts, down the wall of the Laboratory to a cistern, where it meets a stream of cold water that condenses it. The hot water is then conveyed by an under ground gutter to the baths, not more than 12 or 15 yards distant; one of them is kept all day about 70° , a little warmer than Matlock water, and another between 94° and 96° , the lowest degree of Hot bath; but they are made of any temperature to suit the case of the bather, and the heat may be increased during the time of bathing, by turning the cock, which supplies warm water.

ON BATHING IN GENERAL.

The benefits to be derived from bathing are various, but the following appear to be the most general ones.

ABLUTION of the skin is not the least essential object of bathing in all its forms, especially to persons in the habit of wearing flannel next their skin; and as writers have laid so little stress upon this part of the subject, the author has been induced to offer the following observations.

The practice of lavation, to cool and keep the surface of the body clean, is a fundamental

law of animated nature, for the preservation of health.

The human skin is continually emitting vapour from the extremities of its exhalent vessels, consisting of the superfluous and noxious particles of the blood, combined with an oily matter, particularly observable, when condensed upon the surface of the body in the fluid form, called sweat. The cuticle covering the true skin, an inorganic scaly membrane bedewed with this oily mixture, preserves the surface in a soft and sensible state, but from its extreme porosity, favors the production of different kinds of foulness. Therefore, in civil society, washing with soap is daily practised; as the skin is too greasy for common water; and in countries where habiliments are not worn, the dust penetrates so readily through the cuticle, that bathing, and anointing the body are in constant use, to preserve the surface clean, supple, and perspirable.

The accumulation of healthy perspiration does not immediately produce diseases, since married people do not usually contaminate each other, yet when it is long retained on the hot surface of the body, it becomes a source of irritation to the persons themselves, as well as to others. This accumulation sometimes occasions a sour smell from the elements

of sebaceous and phosphoric acids, separated from the body with it, which render the frequent changes of apparel, absolutely necessary.—Clean linen promotes the exhalation of the skin, and like capillary tubes, drinks it up by thousands of months. But when it is not continually renewed, the pores of the skin become obstructed by accumulation of perspirable matter, and the linen gets rotten, or requires much friction and soap, to remove the stains which it had acquired by keeping.

That the retention of this secretion upon the surface of the skin irritates it, appears plainly, from strengthening plasters, which confine the perspirable matter, producing in five or six days pimples, and troublesome itching of the parts beneath; and from the poorer classes of people, being liable to a great number of cutaneous diseases, through defect of cleanliness.

Putrefaction, which is always going on in living bodies, is corrected by food supplying new matter to their systems, and by the exhalation of noxious particles from their surface: hence both animals and plants are rendered healthy, by frequent washing. But as man devours more animal food than other creature, and takes a large proportion of salt with his daily food, his perspiration is more acrid, and he has a more copious exhalation from the surface of

his body, than any other species of the same kingdom. The human body loses by its surface above fifty ounces in 24 hours, near a third of which is exhaled from the lungs, of so poisonous a nature as to destroy animals who breathe it, in a short space of time; and the alternation of the cuticular and pulmonary secretions with each other, is a fact supported by every phenomenon of perfect animals.

If then the retention of the secretion of the skin, from accumulated matter obstructing its pores, prove detrimental to the healthy state of the body, how much greater must the injury be when it is in a state of disease? The retention of perspiration in persons labouring under febrile disorders, has often generated the most deleterious contagion, where the atmosphere has been impure or confined. And the importance of all kinds of bathing, which removes acrid particles from the cutaneous pores, in every part of the body, and gives the entire vessels of the skin activity to increase the proportion of their exhalation, may be perfectly understood from the refreshing effects of the partial washings in daily use among all civilized nations.

Bathing is practised by many people as a LUXURY, not merely from its agreeable operation on the sentient surface, but also from its salutary effects on the general system. The cold

bath exhilarates the spirits, and gives the sensation of a vigorous well being, which words cannot express. In like manner hot and tepid baths produce tranquillity of mind, and bodily repose. The warmth affords a pleasing sensation to the nerves of the skin, and acts on the muscular fibres in removing fatigue like a charm; and baths of every kind, when they agree with the constitution, have a tendency to improve the appetite, by increasing the activity of the cutaneous arteries.

Never was a luxury so general in any country, as bathing in all its forms among the Greeks and Romans. There were eight hundred and fifty-six public baths, besides numerous private ones, in the ancient city of Rome; and the Romans spent so much time in going through the different processes at the baths, that they had hardly leisure to eat one meal a day.*

Another salutary purport of bathing, more particularly in the cold bath, is, to LESSEN the IRRITABILITY of the skin, and to destroy its susceptibility to slight impressions, which renders it a powerful preventive of diseases. That the degree of sensibility of the skin, depends upon the stimulus it is in the habit of receiving, may be illustrated by many familiar instances, of people rendered irritable by warm cloathing,

* H. Mercurial de art Gym. lib. i. cap. ii.

and living in heated rooms, or by long residence under the influence of a vertical sun, which keeps the surface in a perpetual state of heat and moisture. The greater tenderness of the feet than of the hands and face, which are more vascular and nervous, arises from the heat they are always kept in, and their total exclusion from the tonic powers of a cold atmosphere. Hence the lower classes of people in the highlands of Scotland, and north of Ireland, endure the continued application of water and frost to their naked feet, with impunity; while their southern neighbours get cattarrhs, and bowel complaints, from the slightest humidity communicated to their feet, through a thin pair of shoes. In like manner, people from tropical countries are little able to bear even the coldness of the summers of Britain, for some years after their arrival; and several East India gentlemen have told the author, that the Buxton water, which was recommended to them as a tepid bath, proved an intolerable cold one.

But heated chambers are the most general of all causes of the diseases of this country. Men acquire thereby a degree of tenderness, which exposes them to perpetual cattarrhs, from the natural state of the atmosphere. The variations in the climate of Britain often exceed 25 degrees in 24 hours, from the cold north-easterly

winds which blow from the Continent, (particularly in the spring and autumn of the year,) alternating with the south-westerly winds, from the Atlantic Ocean; and nothing but early habits of hardiness, can fortify the constitution against the mischievous effects of these sudden transitions. Mankind enjoy the best health, who are constantly exposed to the weather, especially in the periods of infancy and youth, and are subject to the greatest number of diseases, when the seasons confine them to the house, by reason of the circulation of cold air improving the state of the digestive powers, and destroying the irritability of the skin.

In like manner, cold bathing blunts cuticular sensation, and fortifies the body against the sudden variations of an uncertain climate.--- This is remarkable in guides at watering places, spending the greatest part of the day in cold water, without experiencing any disagreeable effects from it; and in the natives of Russia, destroying the susceptibility of the skin, to the stimulus of an unfriendly climate, by accustoming it to the greatest extremes of cold and hot bathing.*

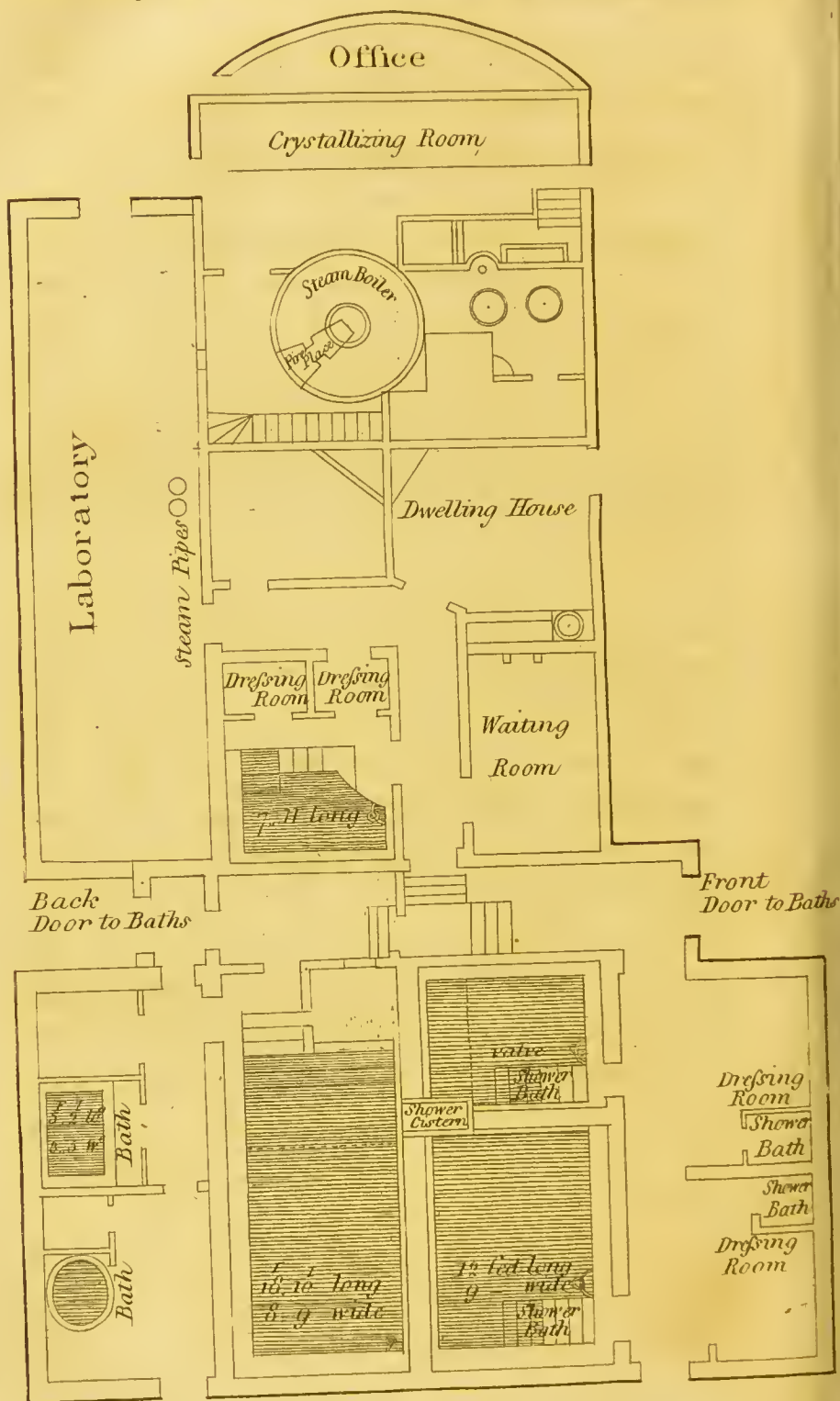
* All ranks of people in Russia, are in the habit of inducing a burning heat, or copious perspiration of the skin, by the vapor bath and friction, and immediately afterwards

Bathing is more employed by adults in this country, for the CURE OF DISEASES, than for any other purposes; but as baths of different kinds and temperatures are required for their application to disorders, they must be considered separately. It cannot however, form a part of the author's plan, to specify the different morbid states of the body, and the various diseases, to which bathing may be rendered subservient. The statement of a few leading circumstances of the difference of baths, and of their most general employment in diseases, are all that come within the limits of this treatise; at the same time it must be premised, that patients should trust to nothing less than a minute consideration of their particular case, before they enter upon bathing. Cold and hot baths, may be generally safe to the healthy, but to the invalid, they are remedies of too powerful a nature, to be matter of indifference in any case. Consumptions, fevers, and rheumatisms, are not uncommon consequences of autumnal visits to the sea; and the physician always finds it

plunging into cold water or snow, which in time becomes a great luxury to them. Vide an account of the Russian baths, in the 2d Edition of Dr. Saunders's *Treatise on Mineral Waters*, accompanied with many judicious observations on bathing, and a description of those in Finland, in a valuable *Treatise on sea-bathing*, by Dr. A. P. Buchan.



MANUFACTORY for SALTS and PLAN of the New Baths at CHELTENHAM.



necessary to be extremely cautious in giving his opinion respecting bathing, in cases of obstructed viscera, and local plethora.

ON THE DIFFERENT KINDS OF BATHING.

The **COLD BATH** may be considered as including every degree of heat between 32° , the freezing point of Farenheit's scale, and 66° , the temperature of Matlock water; but the one most commonly selected for use, is about 60° ; which is the heat of the sea near the shores in the autumnal months, and the mean temperature of covered springs during the year, in the island of Britain.

This temperature suddenly applied to the extended surface of the naked skin, at its common heat of 96° , proves a powerful stimulant to the whole body, but more particularly to its cutaneous surface. The severe shock to the nerves of the skin, and the contraction of the external vessels, soon bring on a central reaction of the heart and arteries, which determines the blood to the surface of the body, with greater force than before the shock. Hence the first symptoms of pale skin, shrivelled surface, oppressed breathing, and the occasional occurrence of cramps in the lower extremities, are succeeded by a glow of heat, which removes the constriction from the external parts, and has

always been considered as the criterion of the salutary operation of cold immersion.

The cold Bath, by rousing the general system to action, and increasing the activity of the cutaneous vessels, cures morbid states of the body, where the circulation is languid, and the powers of life inactive. In the rickety and scrofulous habits of young people, in the melancholic and nervous temperaments of middle age, and in most cases of debility unattended with visceral obstruction, it proves a valuable tonic.

The cold bath has likewise been employed with various degrees of success in convulsive diseases, such as tetanus, epilepsy, St. Vitus's dance, hydrophobia, and the hysteric disease. But without doubt it is too dangerous a stimulant for cases of local plethora, hectic fevers, bowel disorders, organic obstructions, internal pains, and the rigidity of old age.

The following will be found the most useful method of conducting the bathing. The autumnal season has always been preferred for sea-bathing, as the temperature of the atmosphere, and of the sea at the shores, approach nearest each other in that season; but in situations where patients can be accommodated with water at any temperature, bathing will not be improper at any time of the year. In this latter case the temperature may be gradually lowered, at different times of bathing, from

that of Buxton water at 82° , to the cold bath at 60° , which will diminish the hazard, in cases where the propriety of cold bathing may at first be doubtful, and will render the shock less alarming to nervous and timid persons. The author has frequently seen children lost, by the inability of mothers to enforce dipping them in cold water, which would have been obviated, by previously accustoming their skin to water in a warmer state.

It is equally improper to plunge into a cold bath, when the body has been overheated by exercise, as it is to bathe, when the body is chilled or fatigued; but it is in general better for the animal heat to be rather above, than below, the natural standard; and highly injurious for persons to continue long naked to cool themselves, before going into the bath; since the augmentation of a few degrees of the natural heat of the body can only increase the degree of stimulus, and consequent re-action of the system, where, as in the latter case, the vital powers may not be able to remove the constriction from the surface, and rouse the activity of the vessels.*

* Dr. Currie often experienced the refreshing effects of plunging into cold water, after the heat of the body had been increased two or three degrees in the hot bath: vide Medical Reports on the effects of water, by Dr. Currie, M. D. 2d Edition, vol. 1. p. 129.

But the practice of the hardy Russian of plunging into the bath in a state of profuse perspiration, which he has performed daily the greater part of his life, would be a hazardous one to the constitution of a Briton, who only bathes occasionally.

As states of corporal repletion and inanition are equally unfit for the cold bath, it cannot be recommended in the same day, with a purgative medicine, although drinking Cheltenham water as a laxative, by no means interdicts the use of cold bathing. Neither can the morning, when the system is empty, be chosen as the best time of the day for bathing; nor immediately after dinner when the vital energies are exerted upon a full stomach. The evening is also an unfit time, on account of the increased velocity of pulse, and sensibility to cold, which usually accompany the digestive process, unless it be intended to produce perspiration in the night. We therefore prefer the forenoon, about two or three hours before dinner, when the system is vigorous and active, as the time for cold bathing, least liable to objection.

On first going into the bath, every part of the body should be cooled alike, for the neglect of wetting the head, is a frequent cause of severe headach, but it is not necessary to plunge in head-foremost. The superior parts of the body may

be wetted with the shower bath, or the patient may walk briskly into the bath, wet the face, and suddenly draw the head under water.

It is nearly a general rule, that the colder the bath is, the less time the patient should continue in it, and the greater his action ought to be in the bath. A few dips or immersion for a few minutes, to allow time to rub the body, will, in general be sufficient to excite re-action, when the bath is very cold, and then there will be no danger of robbing the machine of its animal heat, by long continuance in the water.* Shivering, chattering of the teeth, and slight headach, are common symptoms of beginning re-action, and do not counter-indicate cold bathing; but when the constriction of the skin continues permanent, without the circulation returning to the surface, the bath will be attended with debilitating effects, similar to those which arise

* The abstraction of heat from living bodies by a cold medium, has been employed in a gradual manner, as a successful remedy in particular fevers; but it cannot in any case, be drawn off from the body, to a great amount in a sudden manner; since life depends upon the capacity of animal bodies to preserve equality of heat, under the different circumstances of external media; and when drawn off so suddenly that the body has not time to generate it fast enough for the consumption, inordinate action, and various diseases, generally succeed this direct attack upon the vital principle.

from fatigue, want of food, and exhausting evacuations. When therefore the symptoms of coldness, shivering, head-ach, langor, want of appetite, and low spirits, continue after bathing, a warm fluid, or some kind of cordial should be taken, and the use of the bath remitted for a time, or a warmer one substituted in its stead.

On coming out of the bath, covering with a flannel gown, drying, and rubbing the skin, together with gentle exercise on leaving the bathing-place, will be the most effectual means of rendering the re-action as complete as possible.

The COLD SHOWER BATH differs little from cold immersion, in its effects upon the body. It cannot be considered as producing so effectual a re-action, by the sensation being more lenient. But it has the advantage of being less terrific, and frequently more easily obtained, especially in cold weather. Many people prefer it to cold immersion in the winter season; and persons subject to cramps in the cold bath, find it an excellent substitute, unattended with the risk of producing so painful a symptom. It may also be employed as a preparation, to wet the superior parts of the body on going into a cold bath; or to enable persons to bring themselves in a gradual manner to cold bathing. The different new baths now at Cheltenham, having shower-baths attached to them, af-

ford persons an opportunity to follow the Russian practice, of showering themselves with cold water after coming out of a hot bath.

The **TEPID BATH** includes an extensive range of temperature, from Matlock water at 66°, to the hot bath, at 94°. The practice of tepid bathing obtains more and more every day in this country, both as a medium of health and pleasure. Its soothing, refreshing, and invigorating effects are easily-acquired luxuries; and in diseased states of the body, where the pores of the skin require to be opened without producing profuse perspiration, it proves an invaluable remedy.

The sensation of warmth and not of heat, cannot be considered as much of a stimulant. It produces neither the re-action of a cold bath, nor the permanent stimulus of a hot one: the effects, however, are relative to the degree of the temperature of these baths.

The lowest heat of the natural tepid springs of this country is that of Matlock at 66°, generally considered as the limits of the cold bath. Then follow Bristol water at 74°, Buxton at 82°, and the Cross-bath, in the city of Bath, from 92° to 94°, at a distance from the spring. The lowest degree of these heats, gives a slight shock to the irritable and delicate habit, at the commencement of bathing, and is frequently

employed as preparative for the more stimulating and tonic powers of a cold bath. No remedy can be in more esteem than Buxton water for cases of diminished action and sensation, which follow inflammations of the extremities and joints. Numerous chronic rheumatisms are cured in debilitated habits, by beginning with high degrees of the tepid bath, descending to the temperature of Buxton water, and terminating with that of the sea.

As the superior temperatures of the tepid bath give no shock, nor accelerate the pulse, they are sometimes employed for diseases of the lungs, and hectic states of the body, where neither the cold nor hot baths can be ventured upon with safety. They may also be used in chronic diseases, which require the purging waters of Cheltenham, and in many dry, and scurfy states of the skin; for, like hot baths, they will wash off the humor, and prevent its recurrence, by encouraging the exit of noxious particles through the pores of the skin.

The agreeable sensation, and lenient operation of tepid water, induce many people to remain in the bath above half an hour. The length of time, however, cannot be matter of indifference, where temperatures are various, and their effects depend on the state of the body; and for the same reasons, the duration of the immersion can

only be determined, at the time the baths are to be used.

The HOT BATH may be considered as including all degrees of heat between 94 and 120. The latter temperature is an extreme that the body can bear, when gradually applied to it;* but perhaps the most useful one is about 97 or 98; and water at this temperature being equal to the natural heat of the human body, and greatly superior to that of the atmosphere, when applied to the extended surface of the naked skin, stimulates the general system, without the severity of a shock, but more especially its cutaneous surface. Hence arise the redness of the skin, dilatation of its vessels, increased sensibility to cold, flushing of the face, and the occasional headaches, which so often succeed hot immersion at this temperature.

But the stimulus of external heat is not the only exciting power of the warm bath; for the hot water, by impeding the escape of animal heat from the surface of the body, increases the quantity of secretion from the skin and lungs, and occasions moisture to break out on the

* The hottest of the natural Thermal waters in this kingdom, is that of the king's-bath, in the city of Bath, which has a temperature of 116° immediately from the spring, and is preserved by continually flowing in, at from 100 to 110, in the bathing-places.

forehead, by the accumulation of heat in the system; agreeably to the usual course that nature pursues, in freeing herself from superabundant heat by the process of evaporation.

The variation of a few degrees of heat is attended with different effects on the body. The inferior temperatures of hot baths below the standard of animal heat, neither increase the velocity of the pulse, nor stimulate the system to any great degree. On the contrary, they soothe the sensitive organs, and restore the lost powers of the machine. One most important use of hot bathing, is to alleviate the painful diseases of the urinary organs; and another to promote the passage of concretions through the urinary and biliary channels.

Other most important purposes of baths moderately heated, are to rouse the nervous energy and the languid powers of the general system, which render them useful in palsies, melancholic diseases, and in cold œdematous states of the extremities. Their mild and permanent stimulus has occasioned them to be employed, in scrofulous swellings of the glands of the neck and belly, (especially hot sea-bathing,) aided by the salubrious breezes of the sea: for it hardly admits of a doubt, that saline impregnations increase the virtues of water. The pressure of a denser fluid upon the circulation

of the surface, as well as the stimulus from the saline particles left on the skin, assist the temperature of water in curing diseases. Hence the cause of the saltiness and roughness of the skin, immediately after sea-bathing, and the experience of mariners, that they do not get cold from the spray of the sea, as they do from rain water. They have also been used, time immemorial, for softening the dry, and cleansing the diseased states of the skin, and for retarding the progress of rigidity, which destroys the functions of the body in old age.

But in proportion as the heat of the bath exceeds the natural heat of the skin (96,) the velocity of circulation increases, which renders it essentially necessary to regulate the degree of temperature by the thermometer, as it can never be duly ascertained by the sensations, which vary with the different states of the body and afford no criterion of actual temperature.

Superior degrees of hot water are used after a course of mercury, in spasmodic diseases, in bowel complaints, and in almost all chronic cases, which require copious perspiration; but it is often necessary for this purpose to raise the heat to a hundred degrees during immersion, before the sweat will break out on the forehead. Higher temperatures than that, however, should seldom be resorted to, as they may accelerate

the pulse to a dangerous degree; and should always be avoided, where there are appearances of fulness in the vessels of the head or lungs; which is a principal reason why purgatives and bleeding are so often prescribed, as preparatory steps to the use of hot baths, in full habits.

As baths above 93° accelerate the pulse, they cannot be safe in full states of the stomach, or head, nor, immediately after violent exercise. The best time of the day for hot bathing, will be two or three hours before dinner, without it be intended to bring on profuse perspiration; the evening will then be the most favorable time, to obtain the aids of a warm bed, and copious diluting fluids.

Persons seldom think of plunging into a hot bath as they do into the cold one, where the instantaneous shock is required; and the author has lately met with several instances of disagreeable effects experienced, from plunging into baths which were unequally heated.

The grateful sensation of external heat to the skin, together with the tranquil state of the system, arising from the diminished exertion of the vital powers, induce many people to continue longer in the bath than necessary. The hotter the bath, the less time a patient should remain in it; but the precise period can only be determined by the nature of the disease, and

constitution of the patient; general practice admits of a latitude between ten minutes and half an hour.* Care must be taken not to continue so long as to bring on faintness, or debility.

On coming out of the bath, covering the body as quick as possible with a flannel gown, or warm sheet, and retiring to a warm dressing-room to be wiped dry with heated cloths, will prevent chillness being produced by the atmosphere evaporating water, particularly from the naked skin, in its greatly excited state, immediately out of the bath.

THE VAPOUR BATH, generally extending from a heat of 96° to a 150° , has nearly the same effect on the body, as hot fluid in the condensed state; but the temperature being higher, the intensity of stimulus is greater; hence it increases the velocity of the circulation, and induces perspiration more readily than common hot baths. The patient may safely continue from seven to ten minutes in a tempera-

* The celebrated Count Rumford found no benefit from the common practice of remaining 15 minutes in Harrowgate water at 96° or 97° , three or four times a week; but when he used it every day two hours before dinner, and continued half an hour in the bath each time, his appetite, spirits, and general health, improved in an extraordinary manner.—Vol iii, Essay xiii.

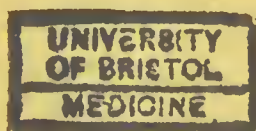
ture of a 110 or 115° suddenly applied. It was in great esteem among the Romans, who diversified bathing in every way possible, and is at present much employed on the continent of Europe, but is still little known in England, although it is a powerful remedy that deserves more attention. Chronic rheumatisms, loss of appetite, cold paroxysms of fever, and diseases of the bowels and stomach, such as flatulency, vomiting, cholic, constipation, diseases of the chest, of the mesenteric glands, and indurated states of the viscera are the morbid conditions of the body, to which it has been most generally applied. It is an excellent remedy locally applied to rheumatic, and obstinate joint cases.

DRY PUMPING is an effectual mode of stimulating particular parts of the body, with either cold or hot water, which is in great reputation at Bath, and derives the name, from the body being kept dry, while water is pumped on its extremities. The partial application of the stimulus of heat or cold, excites warmth and sensibility in torpid organs; and is employed for strains of tendons or muscles, and for deep seated and obstinate diseases of the joints.

The water is generally used at a high temperature, and from fifty to two or three hundred strokes are given at a time; and the stimulus may be increased to any degree, by increasing the

temperature of the fluid, the number of strokes, and the height of the fall. As it does not usually affect the general system, it may be used daily, and at any hour most convenient.

When we consider that the human body commences nearly in a fluid state, and grows gradually more and more dense, by the actions of life, until the organs are no longer able to perform their functions from rigidity, we can account for the utility of different baths, and for their general operation upon the various states of the body, as they occur in the succeeding periods of life. During the first twenty years of human existence, the soft stamina, in a state of preparation for more mature functions, become subject to diseases of laxity and debility, and they therefore derive greatest benefit from the stimulating and condensing powers of cold water. In the next twenty years, the solids of the machine, in their most perfect and vigorous state, render the body liable to fevers and inflammatory diseases, and it receives greatest benefit from the mild operation of a tepid bath. And in the last twenty years of human duration, the rigid materials in a state of decay, subject the body to diseases of debility, and ill-performed actions, and it receives greatest benefit from the warming and softening powers of the hot bath.



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